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ABSTRACT

This document is intended as a guide to directions in Australia's social, economic, and technical future as related to likely trends in the demand for telecommunication facilities in the early Twenty-First Century. From this exploration of the future of telecommunications, nine policy recommendations were made to guide telecommunication research, planning, and operational management in the more immediate future. Appended is a list of commissioned internal and external supportive studies. (Author/STS)

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TELECOM 2000

An Exploration of the Long-Term Development of Telecommunications in Australia

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Planning Directorate
Australian Telecommunications Commission

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FOREWORD

This report to the Australian Telecommunications Commission covers the work of its National Telecommunications Planning Branch in looking to the future of telecommunications in Australia over the next twenty-five years.

The task was conceived, and has been pursued, as an examination of the capabilities and the role of telecommunications in the society of the future.

The result is that this document is not a detailed blueprint for the working planner. Rather, its purpose and hopefully its achievement, is to provide the Commission with a guide — a guide to possible directions in Australia's social, economic and technical future and to likely trends in demand for telecommunications facilities which the early 21st century will impose.

From this background, broad lines of policy have been developed and strategies identified which it is recommended the Commission should embrace in its research, planning and operational management over the closing decades of the 20th century.

STATUS OF THE REPORT

The report was presented in December 1975 and is being studied in depth by the Commissioners and within the organisation. Many of the conclusions and recommendations concern matters which rest solely within the purview of the Commission. Others are more wide-ranging and could be considered contentious by some.

In the course of its work the National Telecommunications Planning Branch has had substantial discussions with many interested organisations and individuals. In order to further facilitate debate the report is being made public before firm conclusions are reached.

Responses are invited and should be forwarded to:

The Manager,
National Telecommunications Planning Branch,
Telecom Australia,
199 William Street,
Melbourne 3000

In order that these responses may be given due weight before final decisions or recommendations are made they should reach the Commission before 30 September 1976.

J. H. Curtis
Managing Director (Dec. 1975)

ACKNOWLEDGEMENTS

The wide-ranging interests of our activities has opened up continuing communications between ourselves and people in many organisations — business, government, social and academic — as well as numerous individuals with an interest in the future.

To all those who have participated through seminars, discussion and correspondence, we express grateful thanks, and particularly to those amongst our study contractors and friends outside the Commission whose interest and personal contributions of time and thought were more than could have been expected. Although all the names concerned are too numerous to cite, those of John Burke and Alex Wearing deserve special mention; they contributed materially to the identification and debate of social issues, providing a valued adjunct to the contracted work. Likewise, the help and encouragement of colleagues within the Commission was invaluable — in particular the support of Ron Turnbull, the leader of the former Planning and Research Divison.

Whilst the report benefits from the experience of all its contributors, there will doubtless be aspects with which they, as individuals, would disagree. We in NTP must bear responsibility for the final product.

Tony Newstead

Tony Newstead
for the NTP Team (Dec. 1975)

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PART A
SUMMARY

1. INTRODUCTION

TECHNOLOGY AND SOCIETY — THE PLANNING DILEMMA

The ability of technology to provide society with almost anything it wants has been described by U Thant as 'the central stupendous fact of our times'. But what exactly will society want?

Society's needs, technology, and the social effects of technology are all interacting parts of a continuous process — a sort of complex chain reaction. There is nothing novel in emphasising the uneasy partnership that exists between technology and society; in emphasising the complex and often ambivalent effects of much technological development — some good for society, some bad. Basically, the ambivalence stems from the very nature of the two systems. To strike a sharp distinction — technology can be described as rationally based, scientific, logical. The social system is a human, living system; one in which large measures of irrationality, illogicality and unpredictability are likely to be encountered in its development.

How can we plan for telecommunications in a future society? Long-term planning is certainly no newcomer to the Australian telecommunications scene, where the demands for new services require huge investments — currently over $700 million per annum in plant and equipment, most of which has lifetimes of 15–25 years or more. The Community Telephone Plan of 1960 was an example of a successful long-term, master-plan. Its objective was the development of the telephone network to the point where subscribers would be able to dial their own calls to any other subscriber in Australia. Now, sixteen years later, the objective has been largely realised.

In the Community Telephone Plan, the objective — subscriber trunk dialling (STD) nationwide — was clear from the outset. Even radical changes in technology would not alter this objective.

A very different problem arises today in determining long-term telecommunications needs, objectives and policies. We are faced with the task of planning new services for markets which do not yet exist, complex technologies which are rapidly changing and a socio-economic environment which, it is widely agreed, is becoming increasingly unstable and turbulent.

Where then do we stand in trying to plan for the year 2000? Is the task as impossible as the following excerpt from Sir Kenneth Clark's 'Civilization' suggests:

> 'We have no idea where we are going, and sweeping, confident articles on the future seem to me, intellectually, the most disreputable of all forms of public utterance'.

If we mean planning in the traditional sense — setting firm targets and producing plans to achieve them — then the answer is probably yes. This type of planning is just not possible for twenty-five years ahead in a rapidly changing world. But there is another approach — a different kind of long-range planning where the emphasis is on the exploration of alternatives rather than on targets, and on planning as an ongoing process in which society is continuously involved. Out of this process of mutual enlightenment will emerge progressively the agreed goals and then, subsequently, the targets, plans and hardware to bring them to reality.

SOCIETY — THE PROSPECT

What will be the general shape of society in the long-term future? George Orwell wrote down his vision of a time — now less than 10 years away — when the total communications system would be used for society's enslavement rather than its enlightenment.

Speculation about the future ranges over a wide spectrum, but it is possible to identify two other main views towards telecommunications and society.

One emphasises the potential of the new and developing technologies to offer a genuine diversity of choice, greater access to all forms of knowledge and greater participation by the community in government itself. The environment of the total communications system, in this view, would serve to strengthen democracy and promote the 'good life' and self-realisation.

The other view tends to be less optimistic. Observers speak glumly of the need 'to put soul in the system', of the fact that 'an audio-visual civilization is being substituted before our eyes for the civilization of the book'. Or, as one sociologist has suggested, the 'wired city' may become a 'city of a thousand ghettos', with each citizen involved in 'the pursuit of loneliness'.

There is also mounting evidence that a major transformation is occurring in the economic base of most Western countries, with a growing emphasis on information-based industries and occupations, and that telecommunications and computers are the key technologies of this transformation. Telecommunications development, in the longer-run, should be seen as having possibly far-reaching social and economic implications; it could contribute towards changing the nature and organisation of work and leisure, socialising patterns, and even the shape of cities and the transportation systems that service them. Whether such changes will bring us closer to a form of active, participatory democracy or to social isolation or totalitarianism depends very greatly on how we manage and organise technology. A framework — institutional, legislative and technical — will need to be developed in the interests of future society. This framework should attempt to strike a balance between the advantages of opposing views — for example, monopoly as against competition, centralisation against decentralisation, widening information access against the desire for personal privacy.

Altogether, then, future events are likely to place a heightened responsibility on the Commission to explore the options — to make known the possible penalties and threats, as well as the advantages involved in new telecommunications development. This is not to say that the Commission should become an arbiter on social issues. But it should be ready to accept the responsibility not only to inform but also to respond to society's views through an ongoing exchange.

TECHNOLOGY — THE PROSPECT

In technical journals and the popular press alike, there is frequent speculation about the potential of future telecommunications; picture-phone services, pocket radio-telephones, access to computers and data banks from homes, schools and offices, electronic accounting instead of money transfers, and virtually unlimited television selection via cable.

All of these things are possible even today, but most would be prohibitively expensive using present technology. The prospect of the new techology now emerging is to make these services available at costs that future users would be able to afford — if they wanted them. The twin keys to this future are digital technology and wideband distribution to subscribers. Digital technology — the technology of computers — makes possible micro-miniaturisation and mass production with potential cost savings that are already being realised in the computer industry. Of a number of new wideband transmission systems, including satellites, the most promising for distribution to individual users is optical fibres which would seem likely to make possible an almost unlimited transmission capacity for voice, video and data, at relatively low cost.

The technological developments are in progress but there are many problems to be solved, and it would be at least a decade before they could begin to be introduced commercially. Meanwhile the capability of the existing 'copper-wire' telephone network could be exploited to provide many of the new services envisaged in 'the wired city', as soon as cheaper terminal devices such as for facsimile services and visual display, become available. However, the telephone network could not carry high quality, 'television' type services.

THE NEED FOR LONG-TERM PLANNING

Against a background of rapid technological change, with all its implications, the need for a new approach in long-term telecommunications planning in Australia was clear. A number of other factors were also pertinent. Apart from the need to plan twenty five years ahead because of the intrinsically long life of telecommunications equipment, this is also the time-scale required to develop major new technology to the stage of proven field application, and for it to become a dominant influence in telecommunications networks. Therefore, better insights into the future would help guide important technological and investment decisions which have to be made in the shorter-term.

THE ESTABLISHMENT OF NTP

The National Telecommunications Planning (NTP) unit was established in mid–1973. Its planning horizon is, nominally, the year 2000. Its objectives:

- To identify future community service needs and recommend Government agreement where necessary to long-term policies, objectives and strategic plans to meet them.
- To recommend the role of the Australian telecommunications authority in providing the various forms of telecommunications in the years ahead.
- To prepare the technical framework which will guide development towards the long-term objectives.

NTP — A FOURTH OBJECTIVE

As the NTP programme evolved, a fourth objective, a process originally envisaged more as a means of attaining the others, was formulated. This was:

- To foster a continuing exchange of views between the Australian telecommunications authority and society about the future development of telecommunication services in Australia.

As work progressed, it was seen that future needs might be assessed and technological solutions planned to meet them, yet these same technological solutions could well act as a catalyst to social and economic change with long-term implications. In other words, a continuous process of interaction between technology and society was anticipated which made continuous community involvement with the planners vital.

From the beginning, too, it was realised that the NTP unit should be a multidisciplinary one. The challenge before the unit was to focus on all the explicit and implicit issues and not to limit its horizons to only the technological ones. An ever growing public awareness of the dangers inherent in applying any technology without first exploring all its possible environmental implications also supported the multi-disciplinary approach. Accordingly, a considerable effort was made to forge a common, integrated outlook rather than merely assign tasks to the specialist interests of team members — engineering, economics, social science and so on.

NTP'S PROGRAMME

NTP's work is directed specifically towards the ongoing need for adequate policies and strategic plans for the Commission. The programme includes a number of technical, social and economic studies either carried out 'in-house' or contracted to outside bodies. These studies are the background to much of this Report, and are listed in Part B.

The social research programme, centred around contract work by three leading university groups, represents a co-ordinated attack on social aspects of telecommunications — an attack which appears to be unmatched in any other country.

The NTP studies are organised to span widely over their fields. Each in its initial stages emphasises breadth and interaction. This means the studies do not become too immersed in detail with a consequent limiting of total coverage. This approach provides a key to gaining progressive comprehension of the total future and also reveals promising approaches for further studies in depth.

In keeping with its objective of fostering a continuing exchange of views with groups in society, NTP has organised a number of open seminars and workshops with groups having a special interest in telecommunications or special perspectives towards Australia's future. These sessions have included the telecommunications manufacturers, the broadcast media, the press, banks, leading social scientists, urban planners, staff associations, educationalists, the computer industry, information specialists, and Australian Government organisations. Where the participants felt it would be useful, standing liaison committees have been formed and meet approximately quarterly.

A series of discussion papers has been circulated both within the organisation and externally on key emerging issues, and responses incorporated in NTP group thinking. Individual team members have addressed a large number of university and business groups, community clubs and associations. At the request of the Senate Standing Committee on Science, Education and the Arts, evidence was presented to it on NTP's activities. A publication, 'Introduction to Telecom 2000', which explains the broad objectives and approaches of NTP's work, has been distributed among secondary schools, municipal councils and other bodies.

Good working relations have been built up with similar long-term study groups abroad — notably in UK, Canada and West Germany. There is regular correspondence with people in such groups, and contacts have been reinforced by visits by several NTP team members. It is fair to say that NTP long-term studies are well respected amongst international researchers in the field.

APPROACHES TO THE FUTURE

Planners can project the present into the future in a 'sequential' way and so predict more of whatever is now occurring or is developing. It is much harder — and very necessary — to disengage from the urgent pressures and constraints of the present and immediate future and conceive the various possible and probable long-term futures. Such conceptions of the future are necessary if the planner is to clear the way for society's judgements about and choices between alternatives, and to aim planning in the direction of whatever society holds to be most desirable.

In literature about the future, two opposed approaches emerge. One is a deterministic view. This holds that the future is determined by the past and hence could, in principle, be forecast given sufficient past data and the tools to interpret it. In this view, events as complex as the weather could be forecast with increasing accuracy and increasingly into the future — given enough meteorological data, a body of weather-prediction theory and data-processing power.

At the other extreme is the view that the future doesn't exist and cannot be forecast but, paradoxically, it can be created. On this view — the normative view — forecasting is scanning possible futures and selecting the one desired. Planning, on this approach, is 'making it happen'. It is, perhaps, epitomised by President Kennedy's normative, 'self-fulfilling' forecast that a man would be placed on the moon by 1970.

Both approaches are valid only within their defined system boundaries; external intervention by acts of God or man plays havoc with both deterministic and normative models. Again, neither view adequately copes with the elusive but central issue of the continuous interaction between the forecast environment and the life within it.

The NTP view is that both deterministic and normative forecasting do have a place in long-range forecasting. They can be reconciled through the recognition that most of the future is likely to lie in the middle ground between the two views; here, in the middle ground, the range of possible futures can be scanned and their expected benefits and penalties explored, along with factors which are likely to favour the realisation of each. Although no precise course can be steered, general directions towards the future can be set. But planning must have sufficient inbuilt flexibility to adapt to subsequent changes.

TELECOMMUNICATIONS — GENERAL PROSPECTS

Uncertain as the future may be, it has been possible to reach some conclusions with a reasonable degree of confidence, to explore alternative courses of development in other more doubtful areas and to identify likely key issues for further study in new, uncharted regions of telecommunications service.

The role of telecommunications will continue to expand beyond its traditional boundaries. Future telecommunications could offer substantial economic and environmental benefits as a low energy alternative to certain types of travel. Telecommunications may also find important roles in education, health and welfare services, the potential for which has scarcely been tapped. A wide range of new business uses of existing and new telecommunications services is likely to emerge and, rising above all, there is the vast potential for new telecommunications services in private homes.

Turning to our standard service, we can expect that, by the turn of the century, there will be a telephone in practically every home and dwelling. With this approaching saturation of domestic telephone service, the rate of growth will decline to less than half the present level, with the initial effects of the decline becoming apparent in the coming decade. The traffic per service will continue to increase, with particular emphasis on long-distance and international calls.

There will be a gradual but important change in the mix of telecommunications business. While telephone growth declines, other services will expand at much greater rates. Existing and new types of data services will grow rapidly, in line with the general increase in computer usage. Facsimile services will develop with community needs for fast, reliable, document transfer. Mobile service demand will respond to the already evident increases in personal mobility. Augmented cable television services are likely to be introduced in the next few years. While it seems unlikely that there will be a high penetration of person-to-person visual communications, some form of 'videophone' service will probably be underway by the 1990s. Videoconferencing is expected to be available from all capital and major provincial centres.

As the telephone network increases in size and services offered, its incremental growth costs will increase slowly. On the other hand, the prospect is that new technologies and efficiencies of scale will result in significant reductions in the incremental costs of those future telecommunications services that today are prohibitively expensive. Despite these cost reductions, investment for newer services will represent a growing proportion of future capital expenditure, and the overall profitability of telecommunications is likely to depend increasingly on these newer services.

The future services and levels of development forecast in Chapter 8, of Part B, should be economically and financially viable. Barring economic catastrophes, the expected increase in future GDP, coupled with the reduced growth in capital demands for new telephone services as telephone density increases, should mean that all feasible levels of demand for the new services could be met with little or no increase in the share of national resources being devoted to the telecommunications sector. Likewise, the increase in real income per capita and the likely income distribution, coupled with the future availability of cheaper technological solutions for these new services, should ensure that services are offered at charges that people can afford.

The range of possible future services is virtually limitless and the problems of increasing diversity will require new approaches by the Commission in its own internal organisation and in the way in which it interfaces with its customers.

OPEN PLANNING AND FIELD RESEARCH

The past decade has seen wide questioning of previously accepted values in our society — values reflected in attitudes about population growth, the role of women, the environment, resource conservation and the unrestrained pursuit of economic growth. A feeling is apparent that the traditional processes — from the level of representative parliamentary government and its administrative departments to public utility, public commission and local government level — are becoming perhaps, too remote, unresponsive, and that new processes need to be devised to counter these trends. The criticism is not so much directed at representative government as we know it, but more a call for supportive machinery as part of the democratic process.

Alvin Toffler makes a pointed comment on what many people see as the situation, in this passage in 'The Futurists':

> '. . . the voter may be polled about specific issues, never about the general state of the preferable future. Indeed, nowhere in politics is there an institution through which an ordinary man can express his ideas about what the distant future ought to look, feel or taste like. He is never asked to think about this, and on the rare occasions when he does, there is no organised way for him to feed his ideas into the arena of politics. Cut off from the future, he becomes a political eunuch . . .'

Somehow people at community level must have more opportunity to participate in major decisions that affect their lives — for example, decisions about urban development, welfare services and the physical environment. In other words, the call is for some sort of broadly-based, flexible open planning.

So far, public interest in open planning in the telecommunications context has been limited to specific cases of concern about the aesthetics of exchange buildings, radio towers or telephone poles in the physical environment. But the social environment will be much more relevant to future telecommunications development, with its potential to bring about important social transformations — for example, the possibility of working from a home or neighbourhood office instead of commuting daily to a central business district. So it is likely, and appropriate, that public pressure for a voice in future decisions about telecommunications purposes and goals will become more acute.

This is an important theme that has emerged in the work. It implies the need for increasing interaction with our customers — potentially the whole of society — about technological and service trends and their implications, and for the organisation of early field research to test the utility and possible side-effects of future services.

Field research refers to trials of new telecommunications facilities in real-life situations and is an important part of the open planning process. The difference from the more common field trial is that the emphasis is primarily on the way in which people respond to, and use, the new facilities rather than on the technology itself. In fact, for the purposes of field research, the technology could well be simulated. Field research helps to bridge the gap of uncertainty about the market for and social adaption to new, unknown, services which conventional market research and theoretical social science are unable to bridge.

While the motivation for open planning stems from what we might describe as social considerations, its objective, in the final analysis, is perfectly consistent with that of an enlightened 'marketing' approach — both seek to uncover the real needs of users and to develop services to meet them.

Open planning can only prove helpful to the Commission in one of its most difficult tasks. That is, to plan future telecommunications in ways that will help people themselves to meet the central challenge that the future will pose — the challenge of adapting to and coping with the demands imposed on them by an increasingly complex, increasingly turbulent society.

2. SUMMARY OF MAIN CONCLUSIONS AND RECOMMENDATIONS

Although a long time-horizon has been inherent in our task, the relevance of the findings must lie in the extent to which they modify more immediate actions — reshaping attitudes, defining policies, and providing new inputs to key decisions — in ways that will steer us better into the future.

This section summarises the conclusions and recommendations of the main body of the report — Part B. For consistency and ease of references, the summaries are given against the same framework as the chapters which form Part B. This results in some duplication of certain recommendations, where similar conclusions have been reached from the standpoint of different chapters. But this serves also to substantiate the underlying importance of those recommendations; they refer mainly to the following areas:

Interdisciplinary Planning	Section 2.1	— Recommendation 1.
	2.13	1.
Open Planning and User Committees	Section 2.1	— Recommendation 3.
	2.9	1.
	2.13	3.
Decentralisation (organisational)	Section 2.1	— Recommendation 2.
	2.13	9.
Field Research	Section 2.1	— Recommendation 4.
	2.11	1.
Computers and Communications	Section 2.6	— Recommendation 1.
	2.13	6.
Telecommunications and Media	Section 2.5	— Recommendation 9.
	2.13	7.

Recommendations which appear in more than one section are indicated by a dagger (†).

2.1 SOCIAL FUTURES

Nature of Social Science. Social science is concerned with relationships between people as individuals, as groups, as communities, as institutions — and their environment. In attempting to use these relationships in ways which will allow us to come to grips with future possibilities, the biological concept of adaption to the environment has proved to be most fruitful in the analysis of social change. The introduction of this concept into social science moved the emphasis away from the earlier aim of prediction — an aim which, in any case, few social scientists would ever claim for the discipline in a long-term context. Instead, the central aim of social science is now seen as the identification and encouragement of conditions which will enhance the capability of people to adapt to changing environments.

Success or failure to adapt to technology will turn largely on the way in which the technological elements are organised and controlled. For example, the same telecommunications technology that could support active, participatory democracy could also help pave the way for Orwell's '1984' society.

The Environment. Turning now to the environment, the significant features which seem likely to develop over the next 25 years are:

(i) Increasing variety, complexity and 'connectedness' in society.

(ii) Increasing change of all kinds, and consequently

(iii) Increasing difficulty in making forecasts of any kind.

There is widespread agreement that these trends, coupled with a coalescence of power in institutions — multi-nationals, unions, oil producers, etc. — will generate conditions of increasing complexity, unpredictability and turbulence in western societies for the next few decades at least.

In non-turbulent environments of, say, the past 30 years, society's overriding concerns have been less with adaptability and survival and more with growth and efficient production. For these ends, the most fruitful strategies included a large measure of centralisation of decision-making, work specialisation and standardisation of production. Under turbulent conditions these strategies tend to be 'maladaptive' — only worsening the conditions they seek to alleviate. What is needed is greater multi-functionalism in people (to offset over-specialisation), increasing variety, and decentralisation of decision-making. Already the emergence of a common thread is evident in social movements apparently as unrelated as educational reform, the changing status of women and worker participation.

The Commission. Because of the diverse implications of telecommunications development, the Commission's future planning will prove most effective if based on an approach which integrates the views of a number of disciplines. This emphasis on inter-disciplinary planning has been central to the NTP task.

The Commission will need to continue to decentralise its organisation and decision-making to integrate with the continuing trend to decentralisation in future society. This will allow its structure and functions to grow in a flexible way around new telecommunications facilities as they develop, matching the varying needs of local communities.

The flexibility of the organisation would then be appropriate to the task of adapting to changing social conditions, giving the Commission an essential resilience and enhancing its ability to survive in a future turbulent environment.

Stratification in Society. Social stratification already causes disparities in our access and usage of information. At present it is a case of '. . . to him that hath (in the social sense), much (information) shall be given'. Future telecommunications development may merely confirm this situation if it pursues generalised goals such as the 'Wired City' or the 'Information Society'. On the other hand, it is possible to plan telecommunications development in such a way that different ends are achieved.

Planning for the future should look at real life social differences as they exist now in this country: for example, such factors as the role of the sexes, ethnic group, income level, level of skills, literacy and individual values relating to privacy and technology would be of special concern to telecommunications.

Field Research. Field research, which should be seen as an essential part of the planning process, is a primary source of planning data for future services. It offers the opportunity for people to express views on new technological services and provides a less costly source of trial and error learning.

If what we are planning for is important, so too is the way we go about it. To take an example: the provision of advanced telecommunications facilities in a new city can be viewed simply as a means of providing communication between people who are at a distance from each other. But it can also be a means of drawing people together from different backgrounds in common cause with the planners. This activity then becomes a basis for a fuller involvement of the community in its own existence. In particular, field research on proposed new telecommunications services involving shared use of facilities will provide a forum for community interaction at face-to-face level. Shared use can involve a social balance which should always be sought: that is to say, if we enhance the trend towards communication by technology, we should, at the same time, balance it by providing a forum for face-to-face interaction. Shared use also serves to guard against the dangers of new telecommunications facilities re-inforcing social inequalities.

One conclusion to be drawn from the importance of field research is that commitment by the Commission to the development of advanced telecommunications facilities, on a national scale, should not take place in the absence of substantial field research data.

Open Planning. The adaptive responses to turbulent environments include multi-functionalism and the decentralisation of decision making. To satisfy this social objective, open planning should be actively implemented as a way of increasing people's involvement in setting goals. To resist this trend is to invite irresponsible behaviour from users, 'green-ban' type activity — even eventual sabotage — and frustration on the part of planners. Such behaviour illustrates the fundamental mismatch between the technical and human systems — the technical system with its rational, cause and effect principles and the human system with its irrational, but often highly adaptive responses.

This is not to suggest that day-to-day decision making in the Commission should become an open activity. It does, however, suggest that people should have increasing access to the 'how' and 'why' of decision making in fields where it bears on their future. There would certainly be distinct advantages in the establishment of machinery to mediate between the telecommunications authority and communities of interest. Various forms are possible (e.g. consumers' councils, non-formal groups) and the alternative forms should be studied. Non-formal groups having a specific community of interest should be able to recognise that machinery exists for consultation with the Commission.

Interdependency. The dangers of increasing social dependency on a single mode of communications are very real. A community which relied heavily on telecommunications for most of its work functions (e.g. the 'remote office'), its education and its lines of supply would be highly vulnerable to disruption, whether accidental or deliberate. Likewise if the major support systems of society — energy, transportation, communications, etc. — become too closely interdependent and each is designed for maximum 'efficiency', a small dislocation in one system may carry over to others, like a falling pack of cards, to produce a catastrophe.

Future planning of telecommunications at both community and national levels will therefore have to give even greater attention to the need for system resiliency against unforeseen conditions. Design strategies could include inbuilding of greater redundancy and the deliberate decentralisation of the control elements so that plant can function more as free-standing units with less dependence on centralised control.

In summary, it is recommended that the Commission:

1.† Increase support of interdisciplinary planning processes both within the Commission and between the Commission and other interdependent institutions (e.g. urban planning, transportation bodies).

2.† Increasingly develop its organisation structure and planning processes along decentralised lines.

3.† Actively support open planning processes and establish machinery to mediate between itself and communities of interest.

4.† (i) Implement a programme of field research into new and developing facilities.

(ii) Commit itself to the development of advanced telecommunications facilities only after substantial field research data has been secured.

5. Try to ensure that planning for future telecommunications services does not result in a widening of existing social inequalities.

2.2 ECONOMIC FUTURES

A decline in the rate of population growth has been occurring in Australia over several years, primarily through a progressive decrease in the fertility rate. The trend has become more apparent in the last two or three years.

The effect on the rate of economic growth resulting from a fertility decline will be gradual, but will become more apparent progressively with decreasing additions to the labour force in future years. Attention has been drawn to the implications of this decline in the First Report of the National Population Inquiry (Borrie Report) issued early in 1975. Due account has been taken of the Borrie projections in arriving at the estimates of telecommunications demand and growth which appear in Chapter 8 of Part B of the Report. (A population range of 16–22 million, with 18.7 million being most probable).

Apart from lower population growth there is evidence that society has begun to question the validity of high economic growth as an objective in itself.

Changing social attitudes are placing more emphasis on increasing leisure and the provision of services of educational, social and community value. However, the rate of technological development may well permit a revision of social objectives without appreciable loss in physical productivity. In economic terms, the long-term rate of per capita growth of Gross Domestic Product (GDP) may not suffer greatly even if an increasing proportion of resources is diverted to 'non-productive' activities.

Current economic and social developments may have cast some doubt on Australia's ability to maintain the overall growth rate of the last twenty years or so. In particular, problems of inflation and unemployment have arisen over the last two years. Similar problems have occurred, however, at other times in the post war era, and it is unlikely that they will prevent a resumption of growth in the longer term. As the economy recovers, an expanding role is foreseen for the telecommunications industry of the future as a result of technological innovation and society's increasing dependence on information transfer.

One aspect of this trend, highly significant for telecommunications, is the greater call for accumulation, storage and transmission of information. This is reinforced by the growing use of computers for information processing in both the industrial and social spheres. To cope with this development, telecommunications may well need an increasing share of the sum total of the economy's resources devoted to capital expenditure. Nevertheless, at the projected rate of economic growth and with the expected gains through technological development, it should be possible to cope with all reasonable demands for telecommunications services during the next 25 years.

National Resources Available for Telecommunications Investment. The availability of capital resources will depend to a great extent on economic growth and in particular on the level of Gross Domestic Product (GDP). Elsewhere in this Report it has been estimated that, by the year 2000, GDP would range between $120,000m and $200,000m, with a most likely level of $160,000m. (All monetary values are expressed in constant dollars, with the year 1972–73 as a base.)

GDP is the major determinant of Gross Fixed Capital Expenditure (GFCE), which represents the total investment for the whole economy, and this, in turn, is an important determinant of the resources available for telecommunications investment.

Given the present share of GFCE, funds potentially available for investment in telecommunications in the year 2000 would range between $1200m and $2000m per year. However, over the past ten years, public telecommunications' share of GFCE has increased from around 3% to 4.5%. It seems likely that under the influence of technological and social trends the industry could continue to increase as a proportion of the total economy. The industry's share of GFCE could continue to grow, despite a declining telephone growth rate, possibly reaching 6% by the year 2000 given buoyant demand for the new types of services that will then be available. This would mean that expenditure on new telecommunications services in that year could, if demand required it, be financed up to a level of about $3000m.

Telecommunications Investment Requirements. The demand for telecommunications services in the year 2000 has been estimated within upper and lower limits. This range of demand would require an annual rate of investment that could conceivably be as low as $900m and as high as $2700m but is more likely to be at an intermediate value in a range $1500m–$2000m.

The investment potential of the economy appears to be sufficient to meet any likely level of demand. The maximum need for funds would occur only if the upper population and economic growth estimates coincided with a high demand intensity for new telecommunications services. In such an economic climate it would probably not unduly tax the resources of the economy to support this level of investment. At the more likely economic growth rate, the lower investment potential would still be capable of meeting the intermediate investment needs of $1500m–$2000m per year.

The upper limit of telecommunications investment would require average annual growth of about the same level as in the past twenty years — 7% per year. The intermediate level would represent a lower average growth rate of about 4.5% to 5% per year.

Therefore, from these considerations it should be within the capacity of the economy to support whatever level of investment is required to meet expected demand for telecommunications services over the next 25 years; the necessary rate of growth in investment would probably not exceed that of past years.

From this background the following conclusions emerge:

1. Long-term planning ought not be unduly influenced by the transient factors which often dominate the short-term economic outlook.
2. The advent of an information-based society would make the whole community dependent on the operation of the telecommunications network. Information would have to be treated as a commodity in its own right. New concepts of production and measures of economic performance, both within the telecommunications industry and externally, would have to be developed. Revision of

economic theory may also be necessary to encompass these new concepts of value.

3. The most likely growth projection is an annual increase of 3% in per capita GDP (within possible limits of 1.7% and 4.5%), and a 1.1% population increase (within possible limits of 0.7% and 1.9%).

   The implications for future telecommunications investment are:

   (i) With economic growth at or near the lower limit, telecommunications growth might consist of no more than a modest expansion of the telephone network together with a minimal development of other services.

   The amount of investment required would represent about 3% of Gross Fixed Capital Expenditure, which is less than the present telecommunications share of 4.5% but this is considered an unlikely outcome.

   (ii) A progressive implementation of new services, corresponding to the intermediate level of economic growth and of telecommunications demand, appears economically feasible. This would require the telecommunications share of GFCE to be maintained at around 4.5%.

   (iii) An increasing intensity of demand for new types of services coupled with a strong economic growth rate would require the telecommunications share of GFCE to increase at about the same rate as it has done in the past, raising it from the present 4.5% to around 6% by the year 2000. This would still be practicable.

2.3 TECHNICAL FUTURES

Key Technologies. Emerging technologies which appear to have the greatest significance for telecommunications are:

- computers
- digital communications
- wideband distribution media
- mobile radio
- satellites

The Commission is presently devoting significant resources to research, development and planning in all these areas of technology. Two study areas of particular relevance to decisions to be taken in the next decade are: integrated digital switching and transmission networks and optical fibre wideband transmission.

A wideband bothway network capable of supporting a videotelephone service throughout the community is likely to be uneconomic until optical fibre distribution cables are sufficiently developed. Videotelephones are most likely to emerge as private, 'in-house', networks.

It is recommended that the Commission:

1. (i) Reactivate, and advance, network planning studies of the applicability of integrated digital switching and transmission (IST) systems into the Australian telephone network and engage in a suitable programme of research and development to ensure that the Commission is ready to adopt the IST technology at the earliest appropriate time.

   (ii) Sponsor research and development in Australia of optical fibre cables and their application to practical field situations Such a programme has recently commenced within the Research Laboratories.

Network Development. The range of services which can be offered in the future depends greatly on decisions, yet to be made, about the technologies and strategies to be employed in providing distribution media. The quality of the decisions taken will depend on the resources which the Commission devotes to appropriate studies. Distribution media questions will become even more important than they have in the past.

The communications network is likely to continue as a basic 4 kHz telephony network for many years, with exploitation of the existing network, or parts of it to provide new types of service such as data services, facsimile, and slow-scan video. Accordingly, it is recommended that the Commission:

2. (i)† Give increased emphasis to network characterisation studies (the size, location and electrical characteristics of all existing plant) to assist the most effective utilisation of the plant.

   (ii) Consider increasing the cross-sectional area of underground pipes installed in future to minimise the 'ground-opening' costs associated with possible future distribution cables.

2.4 R.F. SPECTRUM AND MOBILE SERVICES

Demand for Mobile Radio Telephony. A great potential demand seems likely for a public, automatic mobile radio-telephony service with access to the switched telephone network. In the future, portable as well as mobile units, will become readily available and costs are expected to fall significantly. In recognition of the marketing opportunities provided by mobile radio-telephony, it is recommended that the Commission:

1. (i) Expedite currently progressing work aimed at issuing a tender schedule for supply of public automatic mobile radio telephony equipment.

   (ii) Introduce and actively market a public automatic mobile radio-telephony service at the earliest possible date.

   (iii) Ensure that planning for the mobile service take account of the high level of potential demand throughout Australia, and in Sydney and Melbourne particularly.

Radio Frequency Spectrum Availability. As demand increases for public and private mobile radio telephony, for broadcasting channels, and for other radio communication services, there will be critical shortage of both VHF (30 MHz–300MHz) and UHF (300 MHz–3000MHz) radio frequency (RF) spectrum. The VHF and UHF spectrum will be exhausted before the year 2000; the efficient use of the resource, and choosing between alternative uses, will become of vital importance to the community. Accordingly it is recommended that the Commission:

2. (i) Maintain a close and continuing liaison with the new RF spectrum management authority.

   (ii) Encourage the holding of a public enquiry into spectrum usage prior to the next World Administrative Radio Conference (1979).

Cellular Mobile Systems. Technological solutions to the forecast spectrum shortage include the provision of wired broadcasting (of radio and TV), thus freeing spectrum, and the use of prospective cellular systems at UHF. These latter systems permit the re-use of spectrum many times within the area of one capital city.

A cellular system in the 820 MHz band seems the most promising solution to meet needs in Sydney after about 1985, if the band is not to be alienated piecemeal by less efficient mobile systems. Accordingly, it is recommended that the Commission:

3. (i) Proceed with studies of cellular mobile radio telephony systems (studies are commencing in the Research Laboratories) and monitoring of overseas developments.

   (ii) Take appropriate action to try to ensure the reservation of blocks of RF spectrum at UHF for the later introduction of cellular mobile radio telephony systems.

2.5 CABLE TELEVISION

This summary surveys the likely growth and the applications of cable television in Australia and highlights policy issues which need to be resolved at Government level.

General Growth Prospects. The main motivation for growth of cable television (CTV) in Australia for many years will be in improving picture quality and extending the choice of entertainment programmes. Because of the limited extent of additional programme material available from remote off-air sources, likely capital limitations, and the uncertain role of private entrepreneurs, initial development in Australia would not be nearly as rapid as, say, in Canada. That country now has 35% penetration of households. In the very long term, high penetration using optical fibre technology is feasible, but by 1990 a level of around 5% of households (about half of present US/UK penetration) is more likely. This could be exceeded if other applications notably pay-TV and educational TV were successful; this in turn depends very much on the pricing policies adopted towards additional services on the cable.

Pay-TV. It is believed there may be a substantial market for pay-TV in Australia. The main problems are organisation and marketing, copyright, and the protection of the interests of established off-air TV broadcasters. The financial position of these latter depends strongly on audience ratings which would be reduced by the existence of competitive entertainment channels.

Social and Welfare Applications. The development of local government, community access and other types of social and welfare services on cable television abroad has so far not met the high hopes of a few years ago. The relatively poor record of public access is mainly due to the fact that it cannot match the expectations of distributed network television viewers. Similar remarks apply to televising local government activities. Nevertheless there are strong social grounds for providing a public-access channel. It is recommended that:

1. One channel be reserved for public access in cable TV systems provided by the Commission.

Education. Impediments to growth of educational TV are largely institutional, coupled with the high cost of production and of software support for interactive services. Also recent research throws some doubt on the ultimate value of the medium for cognitive learning processes. It is recommended that:

2. The Commission take the initiative with educational authorities in jointly planning and undertaking research into and pilot studies of interactive educational television.

Information Services. Although many proposals have been advanced to exploit spare CTV capacity to provide a range of new information services, there are no known systems in commercial operation. The main problems are software development costs and the identification of particular services sufficiently attractive to bring forth demand at the tariffs which would have to be charged. Some services of this type could alternatively be provided over the telephone network and displayed on the home TV receiver. It is recommended that:

3.† In the absence of cable television, research and development proceed on the provision of visual information services which exploit the existing telephone network.

Ownership of CTV Transmission Facilities. Many arguments can be advanced supporting either government, municipal or private ownership of CTV systems. On balance, in Australia, it is recommended that:

4. The Commission should own the physical transmission plant. This stems from substantial economies of common provision which will increase in the long-term if a common-cable medium (optical fibre) becomes available to reticulate both public telecommunications and CTV services.

CTV Operation. There are strong arguments for keeping the entrepreneurial operations of CTV separate from the ownership of physical plant. This would allow competition to develop in supplying programmes and services, and, in turn, encourage innovation, which might otherwise be stifled. It would also provide protection against possible future censorship and political exploitation of CTV aimed at the conditioning and control of society. At the same time, it would be logical and reasonable for the Commission to offer certain information services over the cable. It is recommended that:

5. This principle of separation of ownership and operation be supported in any draft legislation for cable television; this should not exclude provision by the Commission of visual information services.

Franchising and Channel Assignment. It is recommended that:

6. The Commission lease CTV capacity to CTV operators who might be commercial entrepreneurs, institutions, or community groups; guidelines for franchising and channel assignment should be developed by the government committee proposed in recommendation 9. Any interim contractual arrangements be subject to later revision if they conflict with subsequent legislation arising from the work of the proposed committee.
7. The present prohibition on the injection of other than off-air programme material be revoked, but that any contractual arrangements for augmented services be subject to agreement of Australian Broadcasting Control Board pending outcome of the recommended committee's activities. New CTV systems installed should have a capacity of at least 20 channels with capability for injection of programme material at one point at least in addition to the 'headend', and for a response capability equivalent to at least one TV channel bandwidth.

Field Research. Field research into augmented cable television facilities, e.g., education, public access, information services, should be undertaken as soon as practicable to gain experience of user interaction, CTV technology, and organisational forms Such experience would help an assessment of the level of users' satisfaction. A possible location for an initial trial would be one of the new urban growth centres. The question of joint funding with local city development authorities, industry and the Australian Government (e.g. Department of Urban and Regional Development) should be explored. It is recommended that:

8. Concrete proposals for field research of CTV be developed by the Commission.

Proposed Government Committee. It is recommended that:

9.† A Government sponsored committee be established to investigate outstanding aspects of CTV. Committee representation would need to include the Commission, Australian Broadcasting Control Board, Department of the Media, media and educational groups, as well as independent members. Public views should be sought in open hearings. In addition to the specific matters referred to under the headings of Pay-TV and Franchising and Channel Assignment, the recommended committee would need to consider questions of privacy and access, and other social ramifications, responsibility for programme content, franchising of operations, and general matters of programme control.

2.5 COMPUTERS AND COMMUNICATIONS

General. In its short 25 years of existence, the computer has become an indispensable tool of science, business and government. The current growth rate in installed computers, both in Australia and overseas, is 25% per annum, and if this rate of development continues, the computer industry could become one of the largest in the world.

Computer growth, and its strengthening alliance with telecommunications, has resulted in dramatic increases in the growth of data traffic and new data applications. It points to the need for the ongoing development of computer-telecommunication networks to match society's increasing dependence on information.

These developments have profound economic, social and technical implications which will need to be identified and resolved if the joint development of the two sectors is to proceed in harmony to the maximum benefit of the nation.

Standards and Safeguards. The effective development of joint computer-telecommunication networks will be seriously inhibited by the lack of effective standards. Hardware and software standards affecting distributed computer networks (computer-terminal and computer-computer links) are currently not standardised between manufacturers in the computer sector. This increases the difficulties of establishing appropriate standards for the provision of common-carrier networks.

Another subject of concern is the need for individual privacy, and the prevention of unauthorised access to personal files. Individuals will need to be convinced that the level of security and control over access to personal data is satisfactory.

With these two issues in mind, it is recommended that:

1.† The Commission take a leading role in developing machinery to foster the harmonious development of the two sectors and that this be done in three ways:

   (i) By initiating the formation, at Government level, of an Australian organisation operating through 'open' enquiry and comprising representatives from the Commission, telecommunication and computer manufacturers, the public service sector, other users, and the general public; this organisation to examine:

      (a) the formulation of joint national interworking standards, extending beyond the technical issues identified as the Commission's responsibility, and aimed at facilitating inter-connectability and compatibility in the long term.

      (b) the effect, on total national resources, of the different rates of innovation and depreciation in the two sectors;

      (c) questions of privacy, access and the rights of users.

(ii) By continuing to press for agreement through international bodies such as CCITT, ISO, IFIP, OECD,* and others on the setting of standards relating in particular to privacy, access, security, the exclusiveness of proprietary information and the redefinition of copyright in a computer-based environment.

(iii) By supporting the formation of an independent mediatory body, which may or may not be the same as (i) backed by meaningful regulation and/or legislation as necessary; this body to monitor and enforce standards and safeguards for data protection.

Data Terminal Equipment. Data terminals will become more sophisticated and will tend to remain special purpose rather than become 'universal'. The size of new markets necessary to support a particular special purpose terminal will reduce. It is recommended that:

2. The Commission closely re-examine its terminal policy in the light of the expected increase in the use of various types of remote terminals connected to telecommunication lines.

Such re-examination should consider:

(i) The market size at which the future provision of standard terminals will be a viable proposition for special purpose applications.

(ii) Whether, in an endeavour to conserve capital, some terminals, particularly those subject to a high rate of obsolescence as a result of rapid improvements in technology, should be sold to customers over a short term period, rather than leased over a much longer term.

(iii) Whether the Commission should provide a maintenance contract with standard terminals, possibly with provisions for different charges for different service restoration times.

Switched Telephone Network for Data. The intrinsic error rate and the equipment standards of the switched telephone network will combine to limit its widespread use for data transmission. The traffic characteristics of data calls are so different from telephone calls that they may cause network congestion should they proliferate. It is recommended that:

3.† (i) Current network characterisation studies to determine the extent to which the existing network can support a wider range of data services, being vital to data planning, receive a high priority and resources so that the task may be completed quickly.

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*CCITT: Consultative Committee on International Telegraphy and Telephony.
ISO: International Standards Organisation.
IFIP: International Federation of Information Processing.
OECD: Organisation for Economic Co-operation and Development.

(ii) The future planned use of the switched telephone network for data services take much more account of the operational and traffic parameters of data users, to determine the extent to which they may differ from normal telephone network design parameters.

Private Data Networks. Most private data networks in Australia are institutionally based and are expected to remain so for some time. Also, the amount of data communication between organisations within these institutions is presently low. These two conclusions point towards a continued growth in private data networks over the next 10 years. It is recommended that:

4. The Commission increasingly respond to user needs through further liberalisation of policies relating to innovation and efficiency in private line utilisation; examples are the current moves to liberalise policies relating to sharing of leased lines and to integrated modems.

Public Data Networks. There is expected to be a need to provide improved public data communication facilities in the short to medium term. Coupled with the expected increased use of computers, there will be advantages in providing such improved services by means of a digital transmission capability, particularly for those special needs involving high speed, low error rate computer-computer transmission.

Also, an increasing need can be seen for the Commission to provide switching facilities for large organisations, as well as an emerging requirement for different organisations to interconnect their data networks. An increasing need for terminals of a number of different organisations to interconnect to large central information system data bases can also be foreseen. These requirements point to the need for a public switched digital data network in the post 10 year term. However, there is a lack of agreement overseas whether circuit or packet switching techniques are most favoured for public switched digital data networks. Local parameters may dictate whether or not a combination of the two techniques might provide the optimum solution for Australia. It is recommended that:

5. (i) Recognising the general long-term trends towards digital telecommunication networks, and the particular advantages of digital operation for data services, the Commission give priority to the provision of a digital transmission capability on those junction and trunk routes having the greatest data traffic potential; this would enable experience to be gained with the technology of digital data transmission, and would be the first step towards the provision at a later date of a public switched digital data network. Demand estimates should take account of likely traffic stimulus resulting from reduced data tariffs that might be possible when digital transmission systems become effectively loaded.

   (ii) An in-depth study of both packet and circuit switching techniques for the Australian data environment be carried out. Such a study should consider the case in which a combination of circuit and packet switching techniques is used, to determine whether such a switched digital data network might best suit Australian conditions.

Computer Networks and Services. Continued improvements in semi-conductor technology will result in rapid developments of both micro-processors and micro-programming. When combined with the expected development of simpler, problem-oriented languages, the result will be a trend towards faster, more powerful and easier-to-program micro- and mini-computers.

Similar improvements in semi-conductor technology, developments in large memory speed and size, and trends towards modular architecture and parallel processing will make the future use of large centralised computer systems viable for certain applications such as large time-sharing and information-base systems.

The desirable extent of telecommunications monopoly is being actively debated in a number of countries. It is recommended that:

6. (i) Recognising the role that computers will have in the future widespread distribution of information, the Commission maintain its present monopoly of public common carrier networks in the case of computer-telecommunications.

   (ii) The Commission support the principle that separation of the telecommunications and data processing sectors is desirable for social reasons to limit the size and power of a large institution.

2.7 VISUAL TELECOMMUNICATIONS

General. Although video telephony has not fulfilled its early expectations, there is a range of other visual telecommunications services 'waiting in the wings' for new technological developments, and rising demand, to become marketable services. To ensure that the Commission can readily recognise trends in technological development and the extent of community acceptance or demand for visual telecommunications services, it is recommended that:

1. (i) All aspects of visual telecommunications be closely monitored until the directions of development are more clearly established.

   (ii) The Commission includes experimentation with various forms of visual telecommunications in any programme of field research.

   (iii) In addition to field research, a programme of research into the positive and negative effects of visual telecommunications be implemented, embracing economic, psychological, physiological, social and organisational aspects.

Videoconference. Growing interest in videoconferencing around the world suggests that extension of the existing Confravision service may present the Commission with a profitable service. In addition, the operation of a marketable and technically acceptable service between most capital cities would offer an ideal opportunity for research into many of the aspects of visual telecommunications. Consolidation of the Confravision network as a profitable Commission service therefore offers several advantages and it is recommended that:

2. (i) Trials of Confravision should be continued with an active marketing approach designed to generate increased community interest, with Canberra included as an additional centre, capable of connection to either existing Melbourne or Sydney facilities.

   (ii) A market survey be conducted to establish the trends in demand for Confravision services.

   (iii) Planning proceed on the assumption that an all-capital city facility will be introduced by the early 1980s utilising demand-assignment techniques on a domestic satellite system. The decision to proceed with implementation would depend on the overall satellite system economics with added Confravision capability.

   (iv) Users of the service be more involved in the design of the next-generation equipment, to establish a balance between technical excellence (and hence cost) and utility.

   (v) The Commission explore the possibility of introducing international videoconferencing. The technical feasibility of such links was demonstrated recently, as a result of an experimental videoconference with a U.K. studio.

2.8 TELECOMMUNICATIONS GROWTH AND SERVICE PROSPECTS

Future Network Services. Emerging technologies offer the potential for a wide range of new telecommunication services operated over existing networks or new broadband subscriber networks. Provision of visual, hardcopy record and computer-assisted (data) terminals could, in concept, make available hundreds of different specialised services in fields such as — media, news and information, business and commerce, banking and insurance, health and welfare, entertainment and education.

Long-term forecasting is difficult enough even for well established services like telephone and telex. For services that do not yet exist it is extremely hazardous and normal market research offers little help. Instead, recourse has to be made to more fundamental studies of human communication needs, motivation and behaviour including users' experience of simulated facilities in the field. This work has commenced but it will be several years before fruitful findings can be expected. Meanwhile, the best that can be done is to make conjectures regarding feasible upper and lower bounds of future demand for these new services, based on alternative sets of assumptions about economic, demographic, social, technological and cost factors. This is presented in Chapter 8 of Part B of the Report.

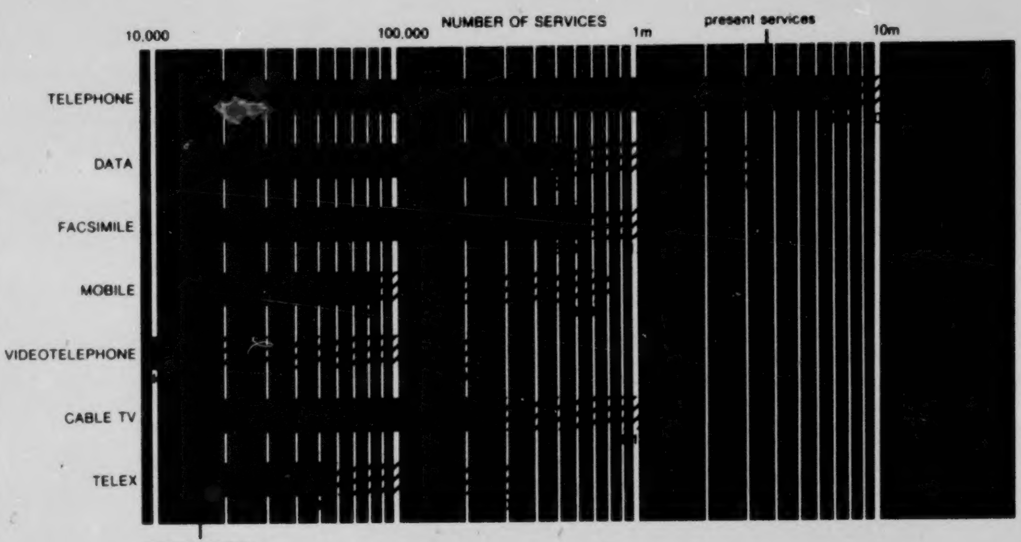
The results of these demand estimates and the corresponding range of telecommunications capital investment needed to support them are summarised in the chart attached. It should be stressed that, for other than telephone service, these are only initial 'ball-park' estimates of possible demand, based on very limited experience and data. (Investment is in 1972/73 money values.) The chart shows the likely upper and lower limits to demand for different services, and resultant capital expenditure. The total capital expenditure shown is obtained by simple addition of the different services, and does not take account of the interdependence of services. That is, it is most unlikely that all services would be at the minimum or maximum levels simultaneously.

Telephone Services. The most probable level of demand for telephone services at year 2000 is 8.7 million. This corresponds to an average of 1.1 services per domestic dwelling, in addition to meeting the expected level of business demand.

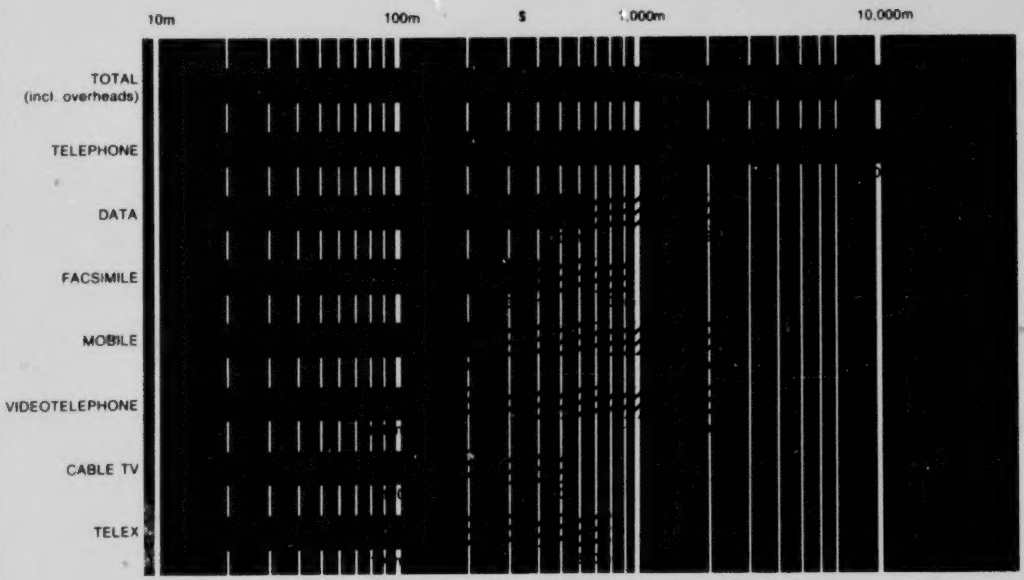
Future Network Traffic. Development of existing and potential new services is expected to generate network traffic growth of the following order:

Telephone traffic in the local network is expected to continue to grow at approximately 6% p.a. until 2000. New information services provided on the switched telephone network are expected to generate sufficient traffic to offset the declining rates of connection of new subscribers, forecast for the long range future.

Traffic on the national trunk network is expected to continue to increase at approximately 12% p.a. for the next decade, gradually decreasing to a growth of about 8% p.a. at 2000 as lower calling rate subscribers are added to the local networks.



Possible range of telecommunication demand—year 2000



Possible range of aggregated telecommunication capital investment 1975–2000

International traffic is expected to continue to increase over the next decade at approximately 30% p.a., stimulated by the growth in international commerce and travel, and the increasing technical improvement in the international network. At the close of the 1980s, the business proportion of this traffic is expected to decrease, and the annual growth by 2000 is likely to have declined to 15 to 20% p.a.

Private Networks and Miscellaneous Circuits. Lines provided to carry non-exchange services, such as private lines, are exerting a growing pressure on the capacity of the network reticulation system. The diverse nature and locations of these miscellaneous circuits in use makes the forecast of future development difficult, but some junction cables in metropolitan business areas have up to 30% of their capacity devoted to non-exchange services.

However the growing demand for data lines, telemetry circuits and private networks suggests that these circuits will represent a growing proportion of the Commission's business in the future, and growth rates of 10–15% are not unlikely.

2.9 INTRODUCTION OF NEW SERVICES

Social Responsibilities. A suitable balance between business performance and the social implications of future decisions requires that the Commission be fully aware of community needs and attitudes which may not necessarily be reflected in the market place. To aid this process, it is recommended that:

1.† The Commission promote establishment of mediating bodies (for example, user representative committees, etc.) to broaden public involvement in telecommunications matters which may affect the community.

Monitoring of Developments. The future has been forecast as one of rapid development in all facets of telecommunications technology, which is likely to contribute to extensive changes in social structure. Combination of these factors indicates the potential for a rapid rise of new markets for telecommunications and for changes in existing or established markets. With these issues in view, it is recommended that:

2. The Commission strengthen existing machinery to monitor and study the interaction of social and economic environments with telecommunications and to make the information generally available.

Selection Criteria for New Services. From consideration of social, technical and marketing criteria, it is possible to identify those services which offer the greatest potential to satisfy community needs, which can be supported by suitable development of technology, and which offer profitable returns on investment. Against this background, which is developed in detail in Chapter 9 of Part B of this Report, the following recommendations have been formulated and provide a guide to the ordered introduction of each service and a basis for necessary planning and marketing studies. These recommendations recognise the state of present technology and the ability of the Commission to offer the service.

No attempt has been made to suggest implementation of market strategies for those services, such as video telephony, whose development is seen to be well into the future.

Facsimile. The relatively high ratings of this service in the social, technical and marketing areas suggests the potential of facsimile as an early Commission service.

Initial growth in facsimile services is expected to be mainly 'in-house' use, that is, within organisations. However, the demand for inter-connectability between services utilising the switched network is forecast to follow on this initial growth, accelerated by an emerging demand for telemail and like services.

The slow development of operational standards for facsimile is expected to inhibit rapid network growth initially. Technological developments which may increase operational speed, simplify use, and reduce terminal costs, are forecast within the next five years.

The introductory strategy for facsimile depends on the Commission making known its intention to market a facsimile service operating on the switched telephone network as soon as such a service becomes practicable, and taking steps to establish operational standards. Against this background, it is recommended that:

3. (i) The Commission actively consider marketing a facsimile service in competition with present suppliers, offering network interconnection with directory listing to Commission-supplied terminals.

   (ii) The Commission further investigate developments in the technology with a view to obtaining, as soon as possible, a supply of suitable terminals capable of, for example, transmission of an A4 page in 30 seconds. A research and development contract with an Australian manufacturer to develop a suitable device locally, should be considered as one possible way of proceeding.

   (iii) Following the results of (ii) the Commission take positive steps to establish local standards for facsimile, and co-operate with the CCITT to have these standards accepted.

Mobile Radiotelephony. Recommendations concerning this subject appear in Section 2.4. For a detailed discussion, see Part B of the Report, Chapter 4.

New Data Services. A detailed discussion on the provision of data networks and the likely development of data services in the future is contained in Part B of the Report, Chapter 6. Dealing here only with 'information' services, it is recommended that:

4. (i)† The Commission evaluate the market for new audio/visual information services which exploit the existing telecommunications network facilities.

   (ii) The Commission seek the co-operation of third parties to provide information content and software support for these services.

Videoconferencing. Of all the video-based services, videoconferencing offers not only the opportunity to provide a potentially profitable service with some community benefit, but also an experimental research basis from which to examine some of the social and technical problems which surround videotelephony. Recommendations concerning videoconferencing appear in Section 2.7. Detailed discussion will be found in Part B of the Report, Chapter 7.

Cable Television and CATV. Recommendations concerning this subject appear in Section 2.5. A more detailed discussion is included in Part B of the Report, Chapter 5.

2.10 ECONOMIC VIABILITY AND TARIFFS

The Changing Telecommunications Pattern. Although the normal telephone service will continue to be the dominant element of the Australian telecommunications system for the next twenty-five years, newer type services of the kind described in this Report will become responsible for a significant proportion of new business. By the year 2000 or thereabouts, annual capital investment on these services may well have overtaken annual investment on telephone services, due to a declining telephone growth rate as penetration of the domestic market increases.

If, as appears likely, annual telecommunications capital expenditure reached $1500m in the year 2000, cumulative capital expenditure between 1975 and then would amount to about $21,000m.

Subscribers' Ability to Pay for Services. It is expected that, by the end of the century, practically all households will have a telephone. Expenditure of the average household for its telephone service has been calculated to represent no more than about 3% of the median household income in 1974, and the proportion is expected to decrease in time as real incomes rise with gains in productivity. Further, it seems likely that subsidies of the pensioner concession type will eventually be extended to disadvantaged groups who would otherwise be unable to subscribe.

At least 10% of households are expected to subscribe for some form of service additional to the telephone. In terms of ability to pay for these services, it is probably a conservative estimate. Data available on distribution of households according to disposable income shows that the upper quartile (25%) should have incomes at least 50% above the level of average weekly earnings. Therefore, the level of household incomes and their distribution is such that there will be sufficient potential subscribers with the capacity to pay for services up to the postulated future levels of demand.

Tariff Approaches. As far as practicable, charges for services ought to reflect the cost of providing them, so as to avoid the possibility of excess demand for uneconomic services. It is recognised, however, that a purely economic approach to tariffs is often impracticable, particularly for some of the more basic services. As an offset to this, it is important to encourage a pattern of usage of new and developing services which would exploit the potential of the network as fully as possible. Differential charges for traffic may be extended, for instance, according to the type of traffic, class of customer, and locality, as well as the familiar time-of-day and distance differentials. Telecommunications services are strategically important in promoting social equity; growing community concern with these values may be expected to influence increasingly the Commission's approach to setting of tariffs.

An important aspect of developing services is that a greater proportion of provision costs of future services will be represented by subscribers' terminal equipment. Within limits, the Commission will be able to choose whether it should provide terminals or permit subscribers to obtain their own. From the financial viewpoint, leasing is favoured in principle because investment in terminals offers a potentially higher rate of return than the funds invested in providing the basic services, thus improving overall profitability. Problems of capital provision, obsolescence and maintenance costs would, however, limit the application of a leasing policy.

2.11 FIELD RESEARCH

There are a number of steps which the Commission might take to secure a more comprehensive understanding of the place of telecommunications in future society. Such an understanding would, naturally, lead to a better appreciation of the market for future telecommunications services and would secure the Commission against any criticism that it was not meeting the telecommunications needs of the community. With this objective in view, it is recommended that:

1.† The Commission conduct a programme of field research into new telecommunications concepts, facilities and equipment. This programme to include:
   (i) an 'in-house' trial of advanced communication facilities;
   (ii) a trial of advanced telecommunications services and facilities in one of the new urban growth centres necessitating continued Commission involvement with the urban planning group directing the project.
2. The Commission commit, in principle, capital expenditure of the order of $500,000 per year for an initial five year period for the field research programme (this corresponds to less than 0.1% of capital works expenditure over the period); additional capital funding should be sought from other appropriate bodies; individual trials within this programme to be subject to normal approval procedures.
3. This field research be adequately publicised, not only among the users involved, but also among telecommunications users at large, and the staff of the Commission.
4. The field research be conceived, applied, managed and analysed within a multi-disciplinary framework, with early involvement of the participants in the planning phases. The Commission should take steps to gain experience in this method of operation to generate suitable methodology for the successful direction of field research.

2.12 OPEN PLANNING

In exploring conditions likely to bear on the success or otherwise of long-term planning, it is essential to take into account growing criticism — both in Australia and abroad — of the traditional mechanisms of government and administration. This is not so much a questioning of representative government as we know it, but rather a call for more open government. The new consensus is that processes need to be devised which can give people at community level more opportunity to participate in decisions that can affect their lives. For the Commission to try to accommodate these views in its planning and decision-making procedures would not be merely to give way to some sectional demand. Indeed, there is strong evidence from recent social theory to support the view that open planning is an appropriate response by an institution to the present conditions of increasing social turbulence and complexity which are the companions of rapid technological and social change.

The call for open planning, in fact, is one important element in a complex underlying process — evident in all Western societies — working towards increased community involvement in decision-making.

Through extensive interaction with a variety of public groups, the Commission's current exploration of future telecommunications is an important first step in responding to this situation. We need to further develop methods of planning and probing the future that provide for properly informed participation by interested groups and yet which permit effective decision making at the point where executive decisions become necessary.

It is important to note that continuing to foster open planning would offer certain long-term advantages to the Commission itself. Put briefly, not only would it assist in reaching decisions more in the public interest in the long run, but, because of the very fact of community participation, it would help in assessing likely public support for particular aspects of Commission policy — for example, support for types of future services. Certainly, it would widen public appreciation of the Commission's work and lead to a better community understanding of the actual problems a public utility faces in its task of providing a service.

The main conclusion drawn from work in this field is that the Commission should enlarge its present efforts to gain experience of the forms of community involvement in open planning in order that it might be in a better position to organise and manage the concept.

There are, of course, difficulties in the way of implementing an open planning philosophy. In confronting these issues it is necessary to review the scope of decisions involved in providing telecommunications services generally and the case for community participation in these various decision areas; of these areas, purely technological decisions would clearly be inappropriate for community involvement. Against this background, the question of the different forms of open planning machinery appropriate to different decision areas can be explored. These are the tasks undertaken in the exploratory Chapter 12 of Part B of the Report.

2.13 THE FUTURE ROLE OF THE TELECOMMUNICATIONS AUTHORITY

Telecommunications and the Economic Infrastructure. Australia's likely transition to a 'post-industrial' society in which tertiary and quaternary (information) industries predominate would cast telecommunications in a central role in the economic infrastructure. Innovation and reliability of services would be paramount in supporting society's increasing need for and dependence on telecommunications. It is recommended that the Commission:

1.† Support an on-going programme of multi-disciplinary studies of future telecommunications.

2. Maintain appropriate resources to monitor the political, economic and social environments and provide a focal point for Commission involvement in a wide area of Government policy issues having telecommunications implications — decentralisation, education, information policies, etc.

Social Role. The increasing dependence of society in the future on telecommunications will imply heightened social responsibilities on the part of the Commission. Provision of new services will need to be perceived by both the users and the Commission as best serving mutual interests, supporting (not impairing) social equity and promoting community development. It is recommended that the Commission:

3.† Explore ways of establishing closer rapport with telecommunication users; for example, by formation of telecommunication user representative groups, or advisory committees.

4. Sponsor studies to identify and (where practicable) quantify the broader social and economic benefits of telecommunications.

5. Further develop product costing so that the profitability of various telecommunications services and of any internal cross-subsidisation can be more fully revealed.

Telecommunications and Computing. The growing alliance between telecommunications and computing will be reflected in both increasing use of joint facilities within society for information services and in the work of the Commission itself in its network plant and equipment. But the telecommunications and computing sectors have developed very differently — for example, with respect to ownership, standards, rates of innovation and depreciation policies. There is need for a closer relationship between the two sectors in the future to secure maximum benefits and conserve national resources. Accordingly, it is recommended that the Commission:

6.† Take up at Government level the question of the establishment of appropriate machinery to study these questions and to define policies for the harmonious development of the telecommunications and computer sectors of the economy.

Telecommunications and the Media. A growing affinity is also forecast between future telecommunications and mass media communications. This will be due, initially, to the Commission's growing involvement in cable telecommunication systems and, subsequently, in likely developments in distribution of a variety of information services, using video-display or facsimile terminals. It is recommended that the Commission:

7.† Initiate, at Government level, an examination of the future relationship between public telecommunications and mass media, with initial emphasis on cable television.

Boundaries to Telecommunications Monopoly. Having studied, in the course of the work, the arguments of monopoly versus competition in telecommunications, the conclusion reached is that, on balance, Australia's interests would be best served by retaining Government monopoly of public common-carrier networks. Nevertheless, there are tangible advantages of competition in certain areas that should be explored. It is recommended that the Commission:

8. Further explore the possibilities of introducing competition in selected areas of telecommunications with particular reference to data communications and 'value-added' services.

Future Organisation. The future is likely to see a widespread and consistent trend towards decentralisation of decision-making in both Government and business organisations. It is recommended that the Commission:

9.† Support the continuing devolution of decision-making to its regional and local administrative units as a means of achieving more effective interaction with telecommunication users at a community level.

GLOSSARY

Adaptive
An adjective describing behaviour which increases the probability of future survival within a particular environment.

Bandwidth (see Frequency; Wavelength; Electromagnetic Wave)
The difference between the highest and lowest frequency contained within a communication signal, or the range of frequencies which can be passed through a communications channel.

CATV — Community Antenna TeleVision (see CTV: Head End)
A television service in which broadcast ('off-air') programmes are received by a single antenna, amplified and distributed within a local area by means of a cable network.

Cellular Mobile Systems (see Mobile)
Mobile radio systems in which a geographic service area is sub-divided into smaller cells. Because of the power and frequencies used, a given portion of spectrum used in one cell can be re-used in other non-adjacent cells. This allows much greater utilisation of the available spectrum in the vicinity of major capital cities where the demands for spectrum are greatest.

Circuit Switching (see Message Switching; Packet Switching)
This enables the establishment of an exclusive connection, on demand, between calling and called parties. No connection is possible if the called party is unavailable. The caller has to try again.

Common Carrier Networks
Networks which are owned and operated by an organisation or authority whose function is to provide common communication facilities to the public. In Australia, this authority is the Australian Telecommunications Commission.

Computer-Computer Link
A link for the transmission of data between computers.

Computer Terminal
A device which can connect to a computer. It may be either at the site of the computer, or be remote from the computer and connected to it through a telecommunication link.

Confravision (or Videoconference)
A conference between two groups of people who are in different locations. Audio and visual communication is provided by TV display and wide bandwidth communication links.

CTV — Cable TeleVision. (see CATV: Head End)
A television service which is reticulated to a limited number of points by means of a cable network. It is more advanced than CATV in that more than 'off-air' TV programmes are reticulated. Possible additional services include: public access broadcasts; educational programmes; sporting events; films. Limited two-way transmission may also be provided.

Data
A general term used to denote basic elements of information such as facts, numbers, letters or symbols which, after being translated into a suitable format can be transmitted to and processed by either a data terminal or a computer.

Database
A structured set of data. The term is principally used for data stored in a computer, which may be accessed using a computer terminal.

Data Terminal
A device which is capable of transmitting and/or receiving data over a telecommunication link.

Data Transmission
The sending of data from one part of a system to another part over a telecommunication link.

Digital Technology
Electronic devices and transmission lines, in which digits — generally binary digits 1 and 0 — are used exclusively for information and processing. Translation to and from an analogue form (e.g. speech, pictures) may be required to interface with people. Digital data operation on the existing network requires conversion of the signal at the network/computer terminal interface by means of a modem.

Distribution Cable (see Exchange; Network; Optical Fibre)
That part of a communication network which connects the subscriber to the exchange.

Electromagnetic Wave (see Frequency; Wavelength; Bandwidth)
A travelling disturbance in space produced by the acceleration of an electric charge, and comprising an electric field at right angles to a magnetic field both moving at the same velocity in a direction normal to the plane containing the fields.
Light waves and waves used in radio are of this nature. The velocity of such waves is constant: 300 million metres/sec. (186,000 miles/sec.)

Exchange
A point (node) of a network at which control of switching and transmission takes place.

Facsimile
A system of information transfer which can transmit the contents of documents. The 'light and shade' of the original document is measured at each point, and the measured value is transmitted to a similar device which reproduces the information at the same relative point of the document.

Frequency (see Bandwidth; Wavelength; Electromagnetic Wave)
The number of vibrations, waves or cycles per second of a periodic phenomenon. The unit of frequency is called HERTZ (1 Hertz = 1 cycle per second).

Gross Domestic Product
The sum of values added in all stages of manufacturing, processing, etc., for all goods and services.

Hard Copy
A written or printed copy of a message, on a permanent or semi-permanent medium; e.g. paper.

Hardware
A computer technical term. The magnetic, mechanical, electric and electronic devices from which a computer is constructed. The individual components such as card readers, card punches, storage units, printers, control units, etc., of which a computer system is composed.

Head End
That portion of a Cable Television network from which all programmes of the network are distributed to the subscriber.

High Speed Transmission
A concept which will become increasingly important as telecommunication between computers becomes more prevalent. Large bandwidth links (several Megahertz) will be needed to enable this to occur.

Information Base (see Database)

Integrated Digital Switching and Transmission
A type of telecommunication network which uses digital technology for both transmission and switching. Translation between analogue and digital signals is required only at the entry and exit points of the network, and not at points within the network.

Integrated Modem (see Modem)
A modem which forms an integral part of the terminal device which it serves.

Junction Route
A set of cables which provides links between exchanges which are within the same local network.

Leased Line
A transmission link, leased from a common carrier for the sole use of one subscriber. It is not a part of any public network.

Local Network
A set of subscribers, exchanges and connecting links within which a single connection is untimed and charged one unit-fee.

Maladaptive
An adjective describing behaviour which reduces the probability of future survival within a particular environment.

Message
A term used in information theory to denote the content of a block of information.

Message Switching (see also Circuit Switching; Packet Switching)
This enables the transmission of whole messages between calling and called parties under the control of the switching system. The switching system involves: reception of the message; disconnection of the caller; temporary storage of the message; retransmission when a line to the called party is available.

Micro-Processor
The elementary building block of a small (micro) computer. It is built up on one or a few semiconductor chips.

Micro Program
A technique of computer programming, used only at the lowest language level, in which basic instructions are built into hardware to improve efficiency and speed.

Mobile Radio Telephony
The telephony sub-set of mobile services.

Mobile Services
Communication services, including telephony, facsimile and data, which are not in a fixed place. In general, radio is used as the transmission medium, although alternatives are possible. Mobile services may operate in private networks, owned by a single user, or can form a public network, owned by a common carrier and shared by many users.

Modem (see Integrated Modem)
A device which provides an interface between data terminal equipment and telecommunication links.

Modular Architecture
The design of structures using standard, pre-designed modules.

Network (see also Switched)
A set of points which are linked together. In the communications context, the points are represented by devices (e.g. Telephone; Telex; Data Terminal and Computer) and the linkages are communication lines which may pass through switching nodes.

Optical Fibre (see also Distribution; Spectrum)
A transmission medium which can transmit frequencies in the range infra-red to ultra-violet (approx. 100–1000 THz).
1 THz = 1 million million hertz).
Fibres are made of a material which is transparent to light, in the form of a tube of diameter approx. 0.1–0.2 mm. In some cases, the tube is filled with a liquid.
Sets of fibres may be made into cables for use as distribution cables.
N.B. This concept is still in the research phase.

Packet Switching
This is a sub-set of message switching. It enables portions of messages in the form of discrete addressed packets to be transmitted between terminals without the need for direct connection.

Parallel Processing
This is a computer technical term. It deals with the internal mode in which a computer handles data.

Pay TV
A subset of Cable Television in which the subscriber pays directly only for what he wants to see (e.g. by coin-in-slot).

Private Network
A network which is limited to a particular group of people. It does not have access to the common carrier network.

Program
An organised set of instructions to a computer.

Public Access (see CTV)
An arrangement whereby individuals or groups of people can devise and transmit programmes via some broadcasting facility to a community.

Public Data Network
A network providing communication facilities to the public which enables the transmission, reception and switching of data between all points of the network.

Redundancy
The use of replication of elements in a system to safeguard against complete breakdown of the system should any one element fail.

Remote Terminal (see also Computer Terminal)
A terminal which is connected over a telecommunication link either to a network, to another terminal or to a computer.

RF Spectrum (see also Spectrum; Frequency)
The Radio-Frequency Spectrum is that portion of the electromagnetic spectrum which lies between 100 kHz and 100 GHz. (1 kHz = 1,000 Hertz; 1 GHz = 1,000 million Hertz.)

Satellite
An object which revolves around the earth, and which is used for the retransmission of radio communication signals between points on the earth's surface.

Scan (see also Slow-Scan)
The process of building a picture on a cathode ray tube screen, such as a TV picture tube. The picture is built by a stream of electrons which impinge on the screen. They are caused to travel across the screen to build lines; as many lines are made as are needed to fill the screen.

Semiconductor
A material whose conductivity lies approximately midway between that of a metal and that of a good insulator. Semiconductors are the basic materials in transistors.

Slow-Scan
A method of transmitting a series of still pictures at a known rate over a medium of narrow bandwidth. The lower the available bandwidth, the longer is the time taken to transmit a picture of a given quality. Closely related to facsimile.

Software
A computer technical term. The totality of programs and routines used to expand the capabilities of a computer such as compilers, assemblers, operational programs, service routines and subroutines.

Spectrum
A range of electromagnetic wave frequencies. The electromagnetic spectrum is a continuum of electromagnetic wave frequencies starting at zero and extending to infinite frequency. The spectrum of light (for example) forms part of this continuum, the radio-frequency spectrum forms another part.

Subscribers Terminal Equipment
The equipment needed by a subscriber (user) of a network to enable him to use the communication facilities of the network (e.g. telephone, teleprinter, facsimile unit).

Switched Telephone Network (see also Network)
A network which allows telephone subscribers to connect, one-to-one, with other subscribers in the network.
The control of connection may be:
Manual — under the control of a manual operator;
Automatic — under the control of the subscriber.

Telemail
The transmission of mail through a telecommunications network by electromagnetic or electrical means.

Telemetry
The transmission of measurement data from remote locations (usually unattended) over telecommunication links.

Telex
A network which connects teleprinters which transmit and receive messages character by character and which provide a hard copy of the messages.

Terminal (see Computer Terminal; Subscribers Terminal Equipment)

Time Sharing
A multi-access data-processing system which provides a terminal user with essentially the full resources of the system whilst sharing the processor time with other active users.

Trunk Route
A set of transmission links (cable, radio, etc.) which interconnects local networks.

UHF
A portion of the RF spectrum, from 300 MHz to 3 GHz. (1 MHz = 1 million Hz; 1 GHz = 1 thousand million Hz)

Value-added services
A concept applied to services which are additional to those normally available on a network, and for which the subscriber pays an additional charge.
Generally, a first party leases a basic service from the common carrier, then re-markets a modified service to second party subscribers.

VHF
A portion of the RF spectrum, from 30 MHz to 300 MHz. (1 MHz = 1 million Hz)

Videoconference (see Confravision)

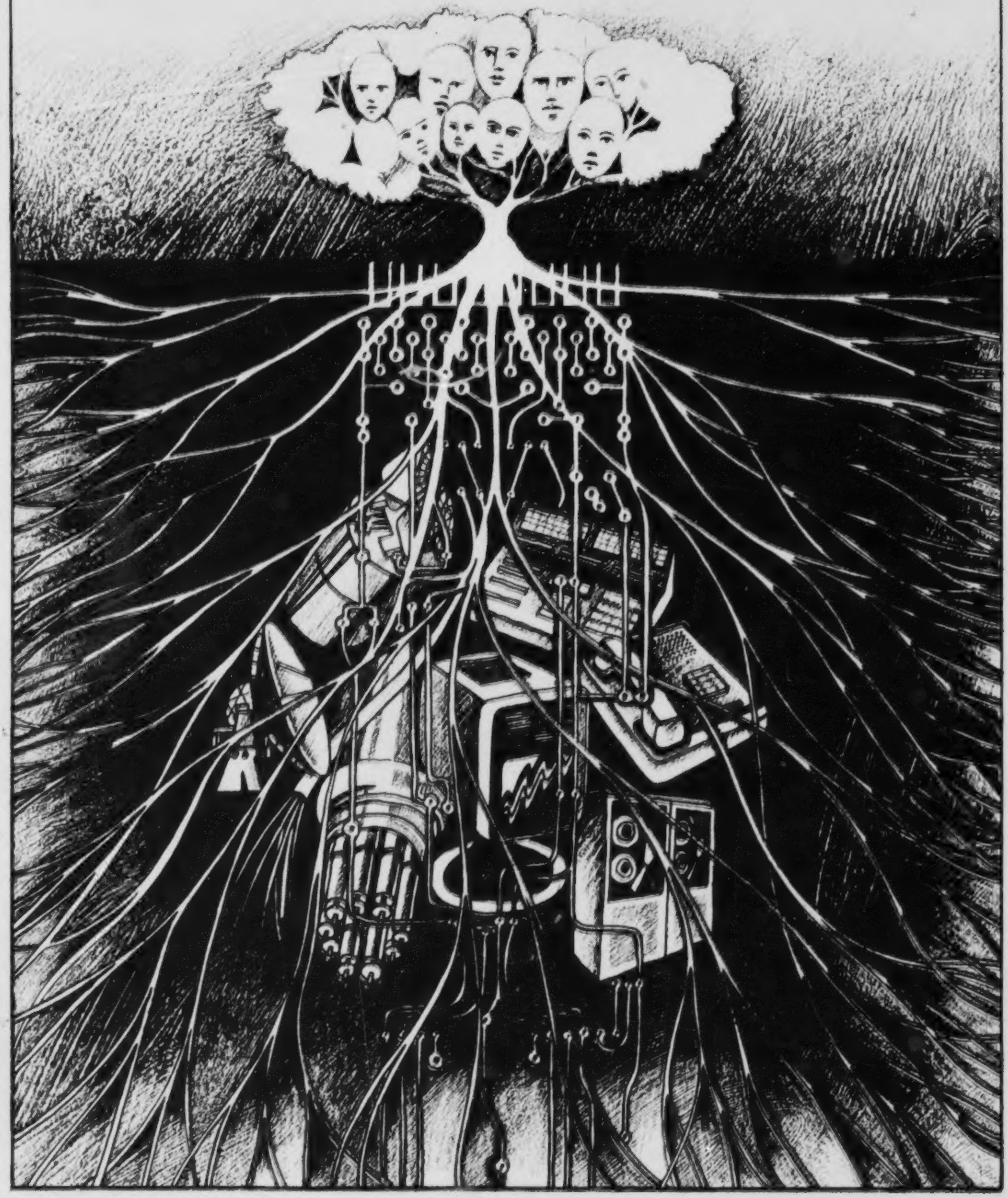
Videophone
A telephone-like device which incorporates a visual communications link in each direction of transmission.

Wavelength (see also Frequency; Bandwidth; Electromagnetic Wave)
The distance between two successive and similar points on an alternating wave; e.g. between two maxima. Each 'location' in the electromagnetic spectrum can be equally well specified by a frequency or a wavelength which is unique to that location.

Wideband Distribution Medium (see also Bandwidth; Distribution Cable)
A medium of electrical or electromagnetic wave transmission which is capable of carrying information whose content has a bandwidth in excess of 100 kHz. (1 kHz = 1,000 Hz)

PART B

1. SOCIAL FUTURES



> 'Industrial technology is the creation of pure reason and pure science with hardly a spark of human emotion and understanding. We have now gone so far along the technological road that we simply cannot do without all of the obvious practical advantages which modern technology has made possible. I only hope that through seminars such as this that we can begin to recognise the need to put a little bit of humanity and common sense back into the grim logic of industrial technology before it further tightens its grip on the remaining pleasures of human existence.'—Ken Turbet, APO Staff Association Seminar November 1974—'Long Term Planning for the Australian Telecommunications Commission.'

1.1 THE LIMITS TO SOCIAL SCIENCE

The inclusion of a social science point of view in the work of National Telecommunications Planning is a recognition of concerns like those expressed above. But, ultimately, it is only action—the actions of people that can humanise the environment in which they live.

In introducing the social science section of this Report, the feeling was that we should first try to define what exactly is the viewpoint of social science within the NTP context, and what are the limits to social science. In essence, social science may be seen as a study of the relationships between people and their total environment—physical and human. One may examine these relationships from several points of view: the relationships between an individual and his environment; between a group and its environment; between communities and their environments; and organisations or institutions and how they relate to their environments.

Each of these levels is interdependent with the other levels. Most people act not only as individuals but also as members of groups, communities, organisations and institutions. Social science attempts to determine, at each of these levels, if there are consistencies in the relationships between human activity and the environment in which this activity takes place. Finally, it attempts to build a framework of knowledge which describes the relevance of these relationships to given purposes—in our case, to incorporate telecommunications adaptively into a changing social environment.

At the level of the individual, the general kinds of relationships which are directly relevant to our purposes are learning and motivation and—more specifically in a telecommunications context—perception and personality processes. This is the domain of psychology.

At the 'group' level (two or more people with a shared goal), the prime focus of study in a telecommunications context is, of course, the basics of communication itself. The group can act as a basic model for the understanding of human communication and interaction, especially in a work-related context. Group behaviour is the area of special interest to social psychology.

At the community level, study centres on those community structures seen as relevant to the establishment of a viable, satisfying community life. Facilities related to community health services, education, leisure activity, information exchange and recreation, are relevant to the satisfaction level of the community and so to the future communal use of telecommunications equipment. Relevant disciplines at the community level include social welfare and sociology.

Sociology and organisational psychology are dominant disciplines at an organisational and institutional level. At this level it is necessary to look at two different kinds of relationships which are relevant to human purposes. The first are the formal organisational structures which would be used to incorporate any developing technology into the existing social system. These structures are, therefore, an extremely important aspect of the analysis of the future utility of telecommunication services.

Secondly, there are the overlapping institutional (i.e., sociological) and cultural (i.e., anthropological) characteristics which structure our social system. Examples of these kinds of relationship are those manifested in class structure, value frameworks, income hierarchy, professional loyalties, sub-cultural classifications, and the roles of the sexes. Existing and projected stratification and segmentation patterns in society will play an important role in the eventual distribution and use of any new technology.

Unlike the subject matter of the physical sciences, social patterns and social inter-relationships cannot, at this time, be meaningfully quantified. Although social quantification can be useful in describing existing relationships in society, it tends to be inappropriate for use as a basis for long-term prediction. Again, because social science concerns interactions which are all part of immediate human experience, there is substantial doubt as to the value of quantification at all. The experience of being 'measured' so alters peoples' responses that any patterns found may be completely misleading in a planning context. While it is one thing to control the variables in, say, a chemistry experiment, it is quite another to control the variables in a social experiment—they are people. All of this implies that social science, at whatever level it is being represented, cannot at present, and probably should never, attempt to predict in the same sense that some of the physical sciences can.

Social science, then, concentrates on the relationships between people, at whatever level, and their environment. In attempting to use these relationships in a manner which will allow us to come to grips with future possibilities, we turn for a basic model to biology.

In biology, the concept of 'adapting to an environment' is central in explaining biological change. Evolution is seen as a continuous interaction between the potentialities in any individual organism and the environment in which it exists. Social science distinguishes between accommodation to an environment (analagous to putting on a gas mask if pollution increases), and adapting within an environment (analagous to removing the pollution from the atmosphere, thus reducing the danger). Adaption requires changes in both the environment and the human elements, as well as in the relationship between them.

This concept was introduced to the social sciences in the 1950s and appears to be as powerful a tool for the analysis of social change as it is for the analysis of biological change. The goals of this kind of social science effort are therefore not prediction but the identification and encouragement of the support conditions which enhance the capability of people to adapt to changing future environments. One may analyse these support conditions at the individual, group, community, institutional or cultural level.

The influence of this kind of approach can be seen in theoretical and field research at each of the previously defined levels. The methodologies which derive from it have been applied in such diverse fields as mental health, work design, community development, organisational change and development, and the study of existing institutional arrangements—particularly within the family and the education system.

In order to apply this kind of approach to interaction between telecommunications and social processes, it is best to begin with a description—in the broadest terms—of the basic characteristics of the environment which, from a study of present trends, might be expected to exist towards the end of the century. Against such a back-drop, the relationships, interactions, and communications patterns which would appear to be most consistent with adaption can then be analysed.

In developing an outline of the most likely possible future environments, this study relies heavily on real life interaction between NTP and participants at seminars, etc., as well as the work of specialists in the field of 'social futures'. A large amount of agreement was found among people NTP interacted with about the shape of possible futures—especially concerning those aspects of the future environment which arouse some fear and misgivings.

1.2 THE TURBULENT ENVIRONMENT

'Systems analysis tells us that wild oscillation is often a premonitory symptom of breakdown . . . these oscillatory movements are evident in . . . the social system too.' Alvin Toffler, 'The Eco Spasm Report', Bantam, 1975.

'One of our present social problems is that we are optimising so strongly the complex interlocking and interdependence of institutions of many sorts that small perturbations of these systems can be catastrophic and lead to complete disruption'. H. Chilver, 'Wider Implications of Catastrophe Theory', Nature. Vol. 254. April 1975.

'. . . the trends foreseen in the economic, social and political scene have changed to a far greater degree than was expected. Interdependency and complexity on a worldwide scale are now seen to be a major factor . . . it is increasingly difficult to distinguish discrete problems and hence propose individual solutions'. OECD document SPT (75)4, 'Committee for Scientific and Technological Policy: Questions for Consideration', April 1975.

As these three quotations indicate, a growing number of independent thinkers—journalists, social scientists, organisation theorists, engineers, economists—support the thesis that the most significant features of the environment likely to develop over the next 25 years are:

- increasing variety, complexity and 'connectedness' in society
- increasing change of all kinds; and consequently
- increasing difficulty in making forecasts of any kind

The main forces acting to produce these factors are consistently defined as:

- the increasing interdependence between the economic sector and all sectors of society
- the special interdependence between science and industry
- the coalescence and centralisation of power in economic units of society (e.g. multi-national oil companies, international unions, etc.) and their impact on decision making
- the increased speed and scale of communications and transportation systems.

Whether the environmental phenomena described above are referred to as 'turbulence', 'overconnectedness' or 'eco-spasm', or merely described in general terms (as in most recent OECD publications), there seems to be significant agreement on basic characteristics. This is that there exist in the environment independent forces which are beyond the scope of any single institution to control. Some examples of these forces are inflation, energy shortages, crime waves and monetary crises. Further, these forces may interact with our behaviour in very uncomfortable ways to reinforce the turbulence, thus increasing uncertainty by challenging a 'common sense' basis for behaviour. A topical example is the mutual amplification that occurs between the psychological depression or 'lack of confidence' of businessmen and economic depression.

One symptom of this increasing turbulence and uncertainty is the measurable, growing demand for information to cope with it; the demands of a business executive, for example, for an ever-increasing volume of reports, statistics, studies, journals, conferences, and so on, to guide ever more difficult and complex decisions. What is significant here is the debate on just how information can be used within the constraints of an increasingly complex environment and what role a telecommunications network would play in disseminating this information.

1.3 MALADAPTIVE AND ADAPTIVE RESPONSES

'Emerging from this discussion came a general concern that technology was dragging us along, that the situation was somewhat out of control and there was a future concern that we did not want to be dragged forward by technology.' 'Report of Working Group No. 2; Seminar APO/NTP and Australian Government Organisations', 1975.

Attitudes such as this have continually faced NTP. Large sectors of society (represented in the writings of members of institutions, organisations and communities, and in the words of individuals NTP has interacted with) put the view that there are long-term dangers inherent in the incorporation of sophisticated telecommunications services into our existing social system.

The problem in this Chapter is to attempt to find relationships and trends in present society which could be classified as either adaptive or maladaptive in attempting to cope with a turbulent environment. A maladaptive response is one which will worsen the conditions which it is seeking to improve; in a turbulent environment this may, unfortunately, be that very response which is consistent with traditional, accepted behaviour. For example, arguments will be presented later (see 'Maladaptive Trends') that increasing centralisation of control would be maladaptive in our present circumstances. Yet, centralisation arose as an adaptive response within an earlier, non-turbulent environment where survival was intimately related to access to resources which were available on a competitive basis—growth and incorporation of potential competitors inexorably led to the large, centrally controlled organisations we know today. As Professor R. S. Silver has put it—

> 'The criteria at present adopted for optimisation lead to a trend to ever larger units . . . We have taken from the science of biology the concept of struggle for existence and interpreted that in terms of the large and the powerful, but have ignored the equally important biological concepts of adaption and symbiosis . . . the species which survives is that which has sufficient variety . . . and which learns to live together with other species to their mutual advantage', Prof R. S. Silver 'The Misuses of Science', New Scientist, June 1975.

By looking at possible negative or maladaptive futures, we can then hopefully plan to avoid them by searching for more adaptive trends. In dealing with maladaptive trends, we distinguish between the active responses of formal organisations and institutions in our society (such as the family, the education system, government, the public sector and private industry) and the passive responses of the people who consume the products and services of these organisations and institutions. The active responses tend to be those which are directly related to maladaption, whereas the passive responses are those trends which mainly reinforce whatever maladaptive movements exist but do not produce them—in the way that passive psychological depression reinforces active economic recession.

1.4 MALADAPTIVE TRENDS

Based on interaction with people from a broad spectrum of society, the work of social forecasters, and a fairly detailed study of the available literature on possible maladaptive futures, there appear to be three major classes of maladaptive response to the complexity and uncertainty of turbulence. Each of these responses supports the development of a particular kind of social future. All three seek to ease the problems of decision making—one by artificially reducing the scope of choices available (Authoritarianism/Segmentation), another by deliberately downgrading the personal values implicit in the choice (Dissociation/Evangelicism), and a third by substituting surrogate values at an institutional level (Superficiality/Synoptic Idealism). They are not exclusive categories—elements of all three can be observed in our present society. It is also likely that future society will be characterised by a similar mix. The aim here is to determine which particular trend is more likely to be either enhanced or discouraged by the introduction of sophisticated telecommunications systems.

1.4.1 A Maladaptive Trend—Authoritarianism/Segmentation

'Big Brother is Watching You' George Orwell, '1984'.

'Unlimited access to data banks, relentless capacities for behavioural control, and actuarial prediction of group behaviour would amount to a form of tyranny which would put to shame Hitler, Big Brother, or any gaggle of South American Colonels' M. Dumont, 'Beyond Paranoia', New Scientist, Jan. 1975, p. 198.

There are strong fears in the community that a combination of advanced telecommunication services and increasing centralisation could lead to a situation where Orwell's '1984' is not merely a literary concept but a reality. In terms of social theory, this kind of society is based on the mutual reinforcement of two observable social trends—authoritarianism and segmentation.

On the active side, we have increasing authoritarianism in response to complexity. This authoritarianism is reinforced by passive segmentation of the population into inward looking groups, each seeking to simplify their choices.

The fears of the '1984' type society are based in general on an increasing resort to authoritarian measures to cope with such environmental complexities as the crime wave on the one hand and the so-called 'Information Explosion' on the other. In the former case, authority is used increasingly to define what may or may not be considered socially acceptable behaviour and sophisticated telecommunications technology is used to monitor and control such behaviour. In the latter case, authority is seen as increasingly deciding which information shall be distributed to whom, for what purpose, and by what means. The authoritarian approach to the distribution of information, however, produces its own passive trap, as Ivan Illych points out:

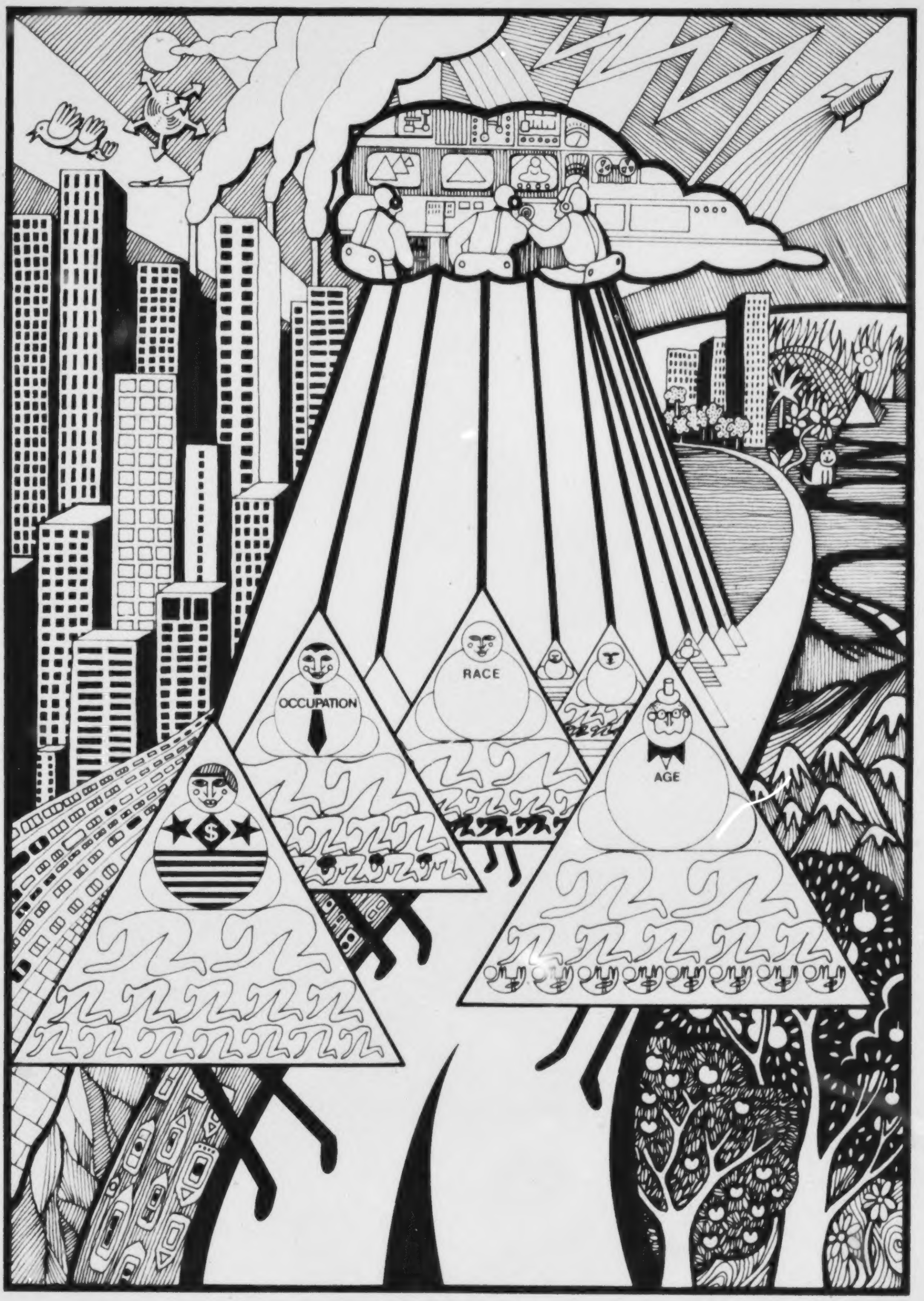
> 'This new mythology of governance by the manipulation of knowledge stock inevitably erodes reliance on government via people. Over-confidence in better knowledge becomes a self-fulfilling prophecy, people first cease to trust their own judgement and then want to be told the truth about what they know.'

How likely is this particular future? In answering this, it is necessary to examine the role of telecommunications technology as it affects:

- the distribution of control in society
- judgements about the nature of information and what its real value is
- where processing or co-ordination of information is located

If a truly authoritarian society were to arise, there would have to be one central source for these three factors (there was indeed such a central source in Nazi Germany—a regime which serves as a model for authoritarian structures). In addition, this central source would have to be supported by massive telecommunications systems for data collection and surveillance. Again, the development of a tight authoritarian society would involve the emergence of overt policies for centralisation of all of the three aspects listed above to be brought together in a single locus of control. We know enough to consciously avoid that path. There will be elements of authoritarianism and there will be elements of segmentation in the use of telecommunications equipment—there already are. However, we do not think that this is the most dominant maladaptive trend which telecommunications technology will have to avoid reinforcing. In particular, future telecommunications and computer systems would not be all that difficult to sabotage and, therefore, are probably inadequate for the production of a true authoritarian society.

Authoritarianism/segmentation. ". . . first society puts me into a compartment and now you want to watch me while I'm in there . . ." ▶


OCCUPATION
RACE
AGE
$

1.4.2 A Maladaptive Trend—Superficiality/Synoptic Idealism

> 'When they think beyond their computers and programs, they think, at the farthest reach, only so far as an actuarial divinity. More distant horizons of hope and despair, the best and the worst, heaven and hell, love and death—delicate interesting horizons—the stuff of madness and art, are erased and replaced with a thin print-out of probabilistic statements' M. Dumont (op. cit.)

Synoptic Idealism refers to the obsession with quantitative descriptions; determining the future on the basis of a synopsis of data concerning the past. This particular active trend is reinforced by the passive and *superficial* relationships which consumers have with the meaning of the goods and services that are produced by a system controlled by the graphs and tables of Synoptic Idealism —consumers responding to image and package, not the product or the service provided. How many of our customers see the telephone service only as the telephone handset? The relevance of this maladaptive scenario to national telecommunications planning has, therefore, more to do with the way in which we plan rather than the technology we are planning for.

This trend is evident in the telecommunications field in a widely held belief that the 'wired city' could be the solution to what is basically the human problem of information distribution and usage. This superficial approach ignores the subtleties of human communication and its social context and the influence of the medium through which it takes place.

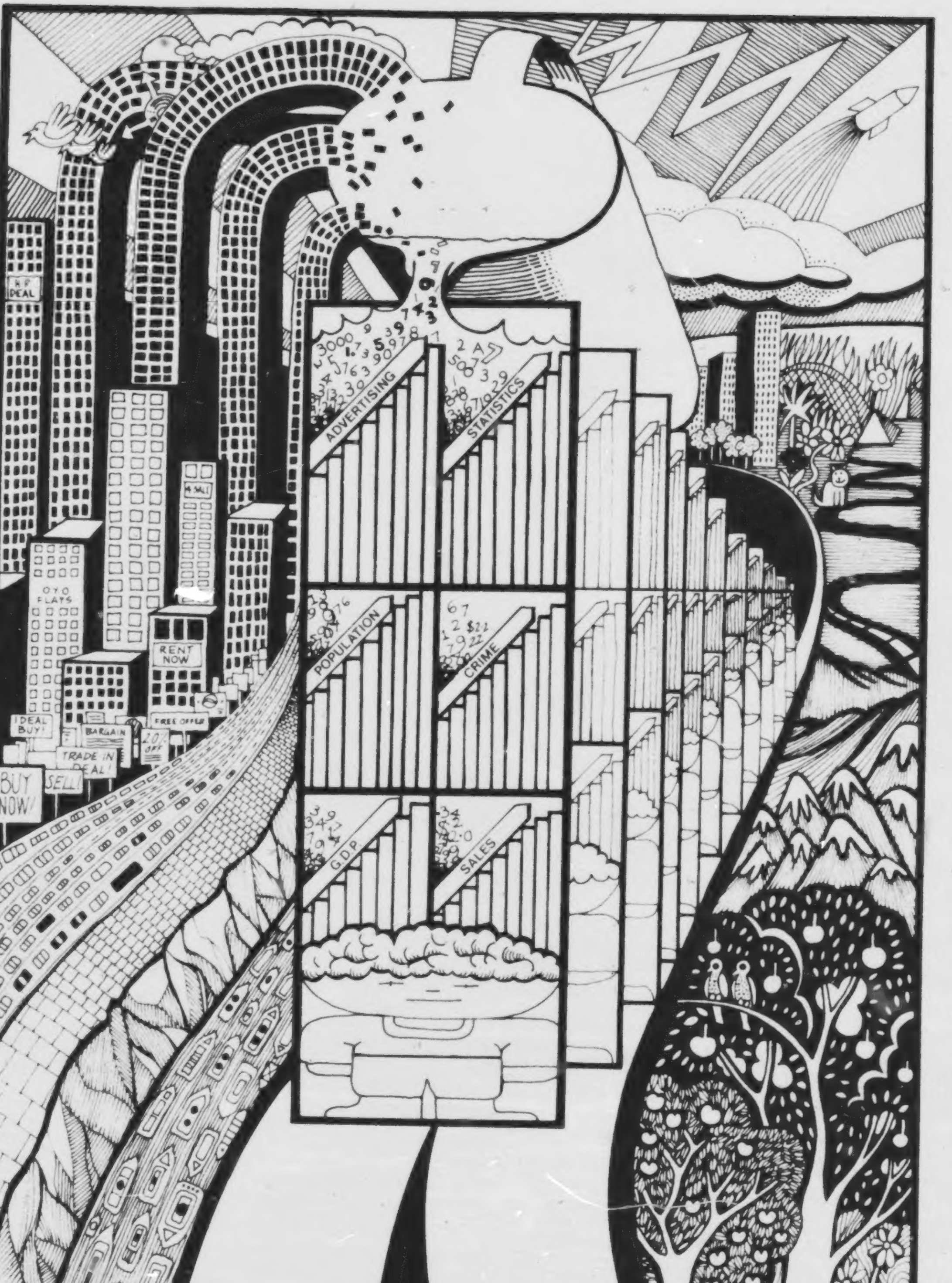
It is NTP's belief, however, that this maladaptive trend will also not be the dominant one. The reasons for this can be seen in the plethora of *non-formal* information channels which have always existed and, in fact, are increasing, especially in Western society; the 'Samizdat' publishing system is an excellent example from behind the Iron Curtain.

In telecommunications, the pressing social realities to which technology needs to respond arise more from existing social stratification—by age, income level, nationality, profession etc., than from superficial concepts of the 'wired city'. At one level we can see that with widening pluralism in Australian society, future telecommunications will need sufficient flexibility—both organisationally and technologically—to cope with increasing diversity, rather than being designed to the needs of a non-existent 'average man'.

At another level we are aware that social sectors which have ready access to telecommunications tend to have access to many information services—for example, upper income groups make most use of public libraries, education services and telecommunications. In contrast, those people whose information access in one area is limited tend to suffer limitations right across the board. The effect of a new technology on this disparity is fairly clear cut . . . 'On the one hand it raises the information level of all individuals; on the other it widens the gap between the "information-rich" and the "information-poor" in society' N. Katzman. 'The Impact of Communications Technology; Promises and Prospects' Journal of Communication, Autumn 1974.

The implication of these two points is that a combination of flexible organisation (e.g. as in greater provision of *shared* facilities) and a more flexibile approach to varying social needs in hardware design (e.g. taking into account the special requirements of women, lower socio-economic groups, migrant groups etc.) will be required in the future. A less superficial response by the users of telecommunications should evolve as a result of this kind of approach.

Superficiality/Synoptic Idealism. ". . . the projections look good, the package is right, the image is fine, but what on earth will it do . . ." ▶


H.P. DEAL
4 SALE
O.Y.O FLATS
RENT NOW
IDEAL BUY!
BARGAIN
FREE OFFER
20% OFF
TRADE IN DEAL!
BUY NOW!
SELL!
ADVERTISING
STATISTICS
POPULATION
CRIME
G.D.P.
SALES

1.4.3 A Maladaptive Trend—Dissociation/Evangelicism

'Alone in a centrally heated air-conditioned capsule, drugged, fed with music and erotic imagery, the parts of his consciousness separated into components that reach everywhere and nowhere, the private citizen of the future will have become one with the end of effort and the triumph of sensation divorced from action'. Pawley, 'The Private Future', 1973.

'We are cynical, uncertain, isolated, drugged, lonely, frightened of intimacy, suspicious of friendship.' Paul Comrie-Thompson, 'Rolling Stone', 17 July 1975.

The terrifying world that Pawley describes in his book, 'Private Futures', is a forecast about what NTP believes may be the most likely maladaptive future which the incorporation of sophisticated telecommunications equipment into our current social context would support. The writer from the journal 'Rolling Stone' describes his own generation, now, in terms that Pawley has used 20,000 km away to describe the possible future.

Dissociation occurs, to use Emery's words, 'when individuals seek to reduce the complexity of choice in their daily lives by denying the relevance or utility of others as co-producers of the ends they seek to obtain'. F. Emery et al. 'Futures We're In', 1974.

Because other human beings are a highly unpredictable part of an increasingly unpredictable environment, there is an increasing tendency evident in Western society to withdraw from human contact. This tendency is reinforced by the technological alternatives to interpersonal communication and by the very behaviour that people, on 'common sense' grounds, attempt to use to solve the problem of complexity; that is, the cynical 'I'm alright Jack' or 'I don't want to be involved' response. It also produces outbursts of violence against the symbols of technology when they frustrate the users—kick the TV set, vandalise the public telephones.

Dissociation is an inevitable outcome of social instability and it is traditionally met by attempts at active Evangelicism—an attempt to impose value back into peoples' lives, to 'win their hearts and minds'; witness the interest in esoteric religions, astrology and mysticism in Western society.

This scenario has special relevance for telecommunications. There is evidence that, in terms of our adaptability with respect to information, we could find ourselves comprising one of two groups. One group, passively swamped in a massive sea of choice between various information alternatives, accepts nothing and becomes involved in nothing, dissociating from what is happening around it. Members of a second, smaller group find themselves in an active, 'evangelical' hunt for that evermore elusive yet decisive piece of information which will finally fill in the gap in the data which they need to carry out their high-level jobs.

Dissociation is being reinforced especially by the evangelical, mythological content of the television medium. Because of the inherent difficulties of presenting contextual information over a video medium, the content of television has been forced into a narrower and narrower and more ritualistic form as it chases the ever elusive ratings. The 'drive' to be entertained increases as the human being increasingly dissociates his inner feelings from his outward behaviour and from the impact of other human beings on his inner feelings. TV titillates inner feelings and reduces the stress involved in observing other people. It re-structures an unappetising environment into an acceptable dream.

The problem extends to the projected combination of sophisticated telecommunications equipment and computers. This combination could act to reduce further those already strained bonds of responsibility which exist between the workers of large bureaucratic service organisations and the clients they serve.

It is, unfortunately, all too easy to dissociate oneself from a harsh task concerning a consumer by saying to him—'It's not my fault, the computer did it'. However, one should not be surprised if the consumer's behaviour towards the institution then becomes equally dissociated, cynical and manipulative.

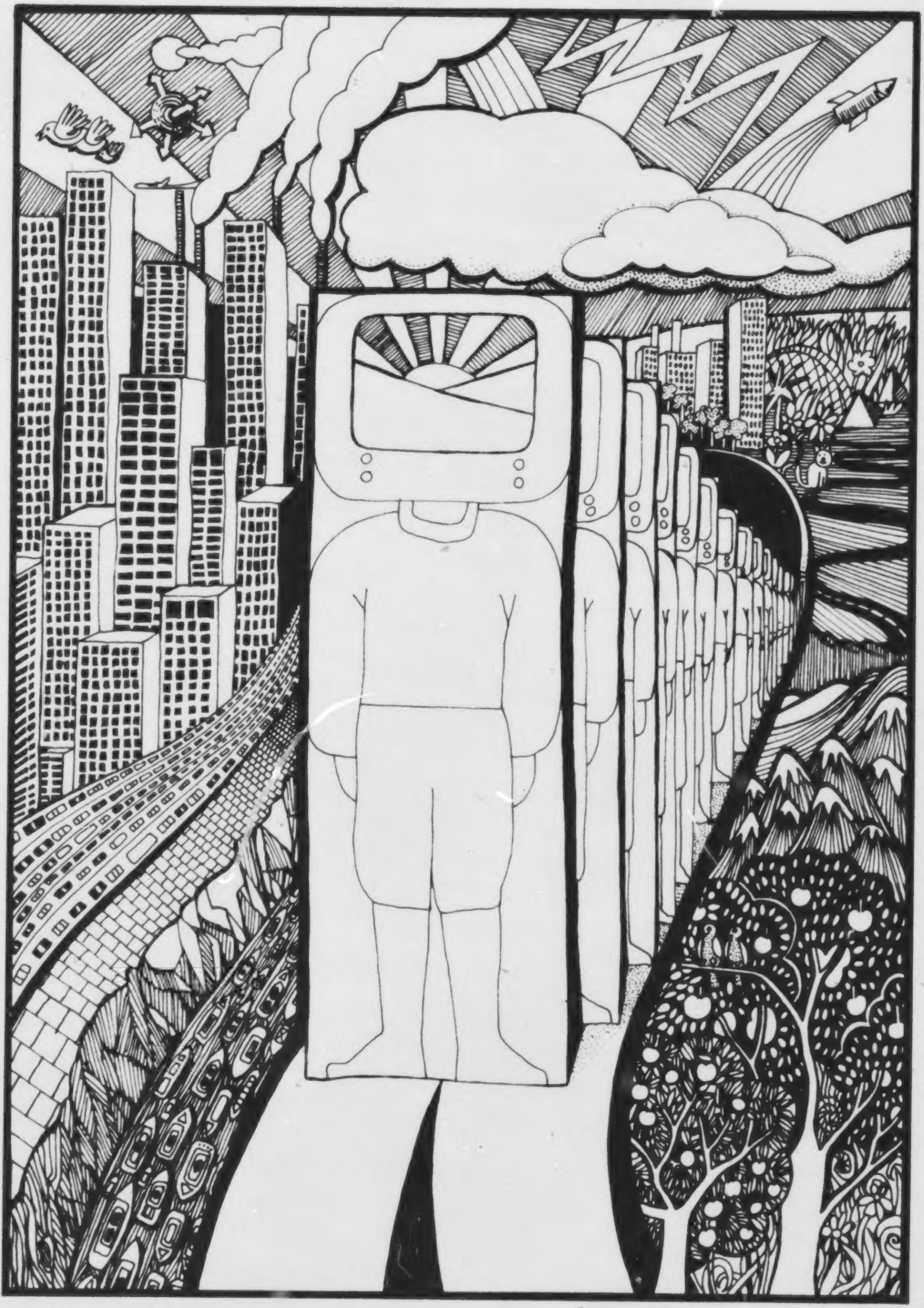
As the distinguished sociologist, Max Weber, has remarked: 'the fully developed bureaucratic mechanism compares with other organisations as does the machine with non-mechanical modes of production'. Its effectiveness, in fact, increases with its dehumanisation and to the extent that, to quote Weber again,—'it succeeds in eliminating from offical business love, hatred and all purely personal, irrational and emotional elements which escape calculation'.

From the organisation's point of view the situation is no better. In this respect it has been claimed that the combination of bureaucracy, computers and telecommunications will dissociate middle management from the fruits of their labour, just as the production line has dissociated workers from the fruits of theirs. Therefore, because of the especial relevance of this particular future to telecommunications planning, great care must be taken not to design systems which increase the physical barriers between human beings, and so further dissociate man's behaviour from his inner reality.

In addition, it is important to question continually what is the real nature of the so-called 'Information Revolution', and avoid the pursuit of 'evangelical' and technological solutions to social problems of ambiguity and complexity.

Dissociation/Evangelicism. ". . . don't stop, don't get involved, we can watch it all on the box tonight . . ."

▶



1.5 ADAPTIVE TRENDS

> 'The choice is between whether a population seeks to enhance its chances of survival by strengthening and elaborating special social mechanisms of control or by increasing the adaptiveness of individual members. The latter is a feasible strategy in a 'turbulent' environment and one to which Western societies seem culturally biased' Emery et al (op. cit.)

In searching for adaptive trends which may give some insight into the most acceptable way of coping with the planning of a national telecommunications system within a turbulent environment, the following real life behaviour patterns appear to be of prime relevance to the task. It should be noted that, although the means of classifying these responses derives from the work of consultants, the behaviour described is real, is occurring in the social field, and can be observed on a day-to-day basis.

1.5.1. An Adaptive Trend—Decentralisation of Control

> 'One of the growing conflicts of the next decade is likely to stem from the persistence of hierarchical organisation forms in our service industries. This industrial form . . . will increasingly be seen as inefficient'. G. Jappert 'Post Affluence', Futurist, 1974.

There is welcome evidence of changes in the fields of education, industrial relations, government, work design and especially urban planning, which appear to be consistent with a recognition that an adaptive response to complexity and turbulence is best supported by decentralised, flexible organisations capable of responding quickly to local conditions. This trend has, in addition, been forecast for the business community in general, both public and private—'. . . from the 'workers councils' of Germany, the 'group decision making' in the USA, to the 'leaderless groups' of Norway—our reference is to what can be labelled 'self management' systems . . . the key word in the changes taking place is flexibility . . . [it] now exists at least in terms of working hours, job design and organisational structure. Although these changes are just beginning, they are visible in many different kinds of organisations in different cultures'. Alvar Elbing and John Gordon, 'Self-Management in the Flexible Organisation', Futures, August 1974.

In order to plan future telecommunications in a manner which is consistent with this adaptive trend, it would be necessary to support increases in local autonomy, so that decisions can be made which are more in harmony with the varying needs of different communities of interest. The needs which telecommunications serve, as has been pointed out, are already highly stratified. A standardised, centrally determined approach to the provision of future telecommunications could not take account of local conditions under the constraints of turbulence and would only reinforce maladaptive trends.

1.5.2. An Adaptive Trend—Decreasing Specialisation

> . . . the nature of the organisation in which the manager operates will change. The concepts of specialisation, standardisation and economy of scale which evolved from scientific management in the past no longer seem appropriate'. Alvar Elbing and John Gordon. (op. cit.)

Throughout the world there is wide and growing recognition that today's complexity is better managed by a decreased level of specialisation. This trend is not only evident amongst planning groups which are increasingly both inter- and multi-disciplinary, but is also found at the work face—as in the 'semi-autonomous work group'; in the family—husbands and wives are increasingly finding a need to exchange some previously specialised roles and to act in a much more generalist fashion; in academic disciplines—e.g. interdisciplinary studies, systems philosophy and methodology; and a general decreasing reliance on, and an increasing resistance to expertise alone as a determinant of planning efficiency.

Under conditions of turbulence, greater specialisation, and particularly specialisation of knowledge, can only increase maladaptive trends. What is required, therefore, is a viewpoint which sees information as a 'generalist' good or service. The most fruitful areas of new knowledge in this century have crossed the boundaries of specialised disciplines. In everyday life, a generalist, 'do it yourself' capability offers not only financial incentives but also widening interests and greater self-reliance. Systems designed purely to the criteria of specialists will become less appropriate to the wide-ranging sets of purposes which are characteristic of turbulence and complexity.

1.5.3. An Adaptive Trend—Open Planning and Increased Access. These are the key adaptive responses—without them future maladaption is almost inevitable. In particular, without them future users of telecommunications services would be deprived of active access to the development of systems which are designed to serve users' purposes. This could only end in a superficial and eventually dissociated response.

The characteristics of an information-laden, turbulent environment require more open access to relevant information in order to maximise development and learning. The strong trends towards recurrent, continuing and open education, are examples of varying means of access to the information system. They are also consistent with the trend towards decreasing specialisation. The education system is increasingly being seen as not serving merely a specialised and centrally determined set of social needs. Rather, it is held, only a 'learning society' can hope to cope with the variety of responses demanded by an increasingly variegated environment.

Learning, however, is impossible without active access to the sources of information required. Access is required because only an informed, involved society can consider the possible structures and functions which may be associated with the responsible use of a new concept (e.g. the videophone). Active access, through field research, is required because only 'hands on' experience can provide both a forum for rational premeditation and trial and error learning; both are necessary for adaption in our society.

Because of the strongly polarised views which are held about technology in our society, and particularly because of the fears that are always in evidence when telecommunications technology is discussed, any attempt at secrecy in planning will be perceived by many people as a deliberate attempt at manipulation and will be resisted. The experience of urban developers with community resistance and urban 'green-bans' should be a stimulus to open planning, which can now be justified not only on the grounds of social theory but also by pragmatic reality. If people are involved in the long-term consequences of any planning study, there are strong arguments for their further involvement in that study — especially if they are expected to act responsibly towards that system when it is developed.

The related subject of Open Planning is discussed in some detail in Chapter 12.

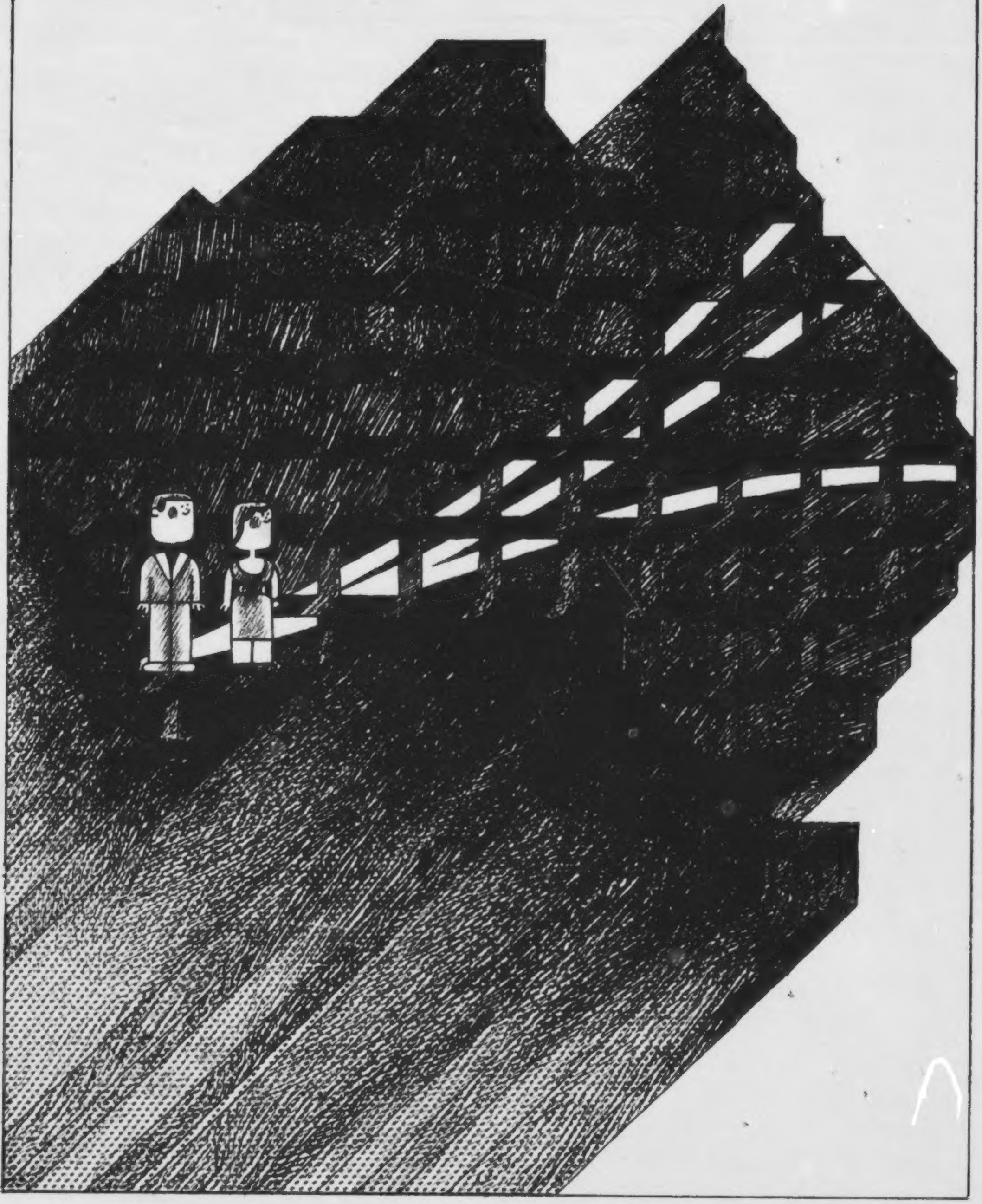
User involvement and, hopefully, responsibility can be increased by the use of shared services. These already exist to some degree within the existing telecommunications system: public telephones, Confravision and telex are all services which involve some degree of shared usage. However, within the context of developing new services, a particular kind of shared service would be most attractive. This is a service where a group of people with some shared purpose mutually decide on the specific nature of the service and agree to share the cost of its provision. In a planning context, this kind of approach has advantages: it tends to increase the users' appreciation of the true costs of providing the service; it supports learning both by users (e.g. about their own needs, about service potential) and the Commission (e.g. about dealing with user groups, about most effective new uses of a service), thus ensuring a less superficial response to the service. It also provides a long-term pool of knowledge about marketing potential and functional characteristics of new services.

RECOMMENDATIONS

Against the background of the discussion in this Chapter, it is recommended that the Commission:

1. **Increase support of inter-disciplinary planning processes both within the Commission and between the Commission and other inter-dependent institutions (e.g. urban planning, transportation bodies).**
2. **Increasingly develop its organisation structure and planning processes along decentralised lines.**
3. **Actively support open planning processes and establish machinery to mediate between itself and communities of interest.**
4. **(i) Implement a programme of field research into new and developing facilities.**
   (ii) Commit itself to the development of advanced telecommunications facilities only after substantial field research data has been secured.
5. **Try to ensure that planning for future telecommunications services does not result in a widening of existing social inequalities.**

2. ECONOMIC FUTURES



2.1 INTRODUCTION

This Chapter surveys, in general outline, the rate of economic development that has been experienced in Australia in the past, and discusses the factors that may be expected to determine the likely extent and direction of further development in the future. Current economic and social developments may have cast some doubt on the ability of this country to maintain the level of growth achieved in the past twenty years or more. However, the rate of economic growth and the expected gains through technological development indicate that economic and capital resources should be sufficient to cope with all reasonable demands for telecommunications services during the next 25 years.

2.2 DEMOGRAPHIC FACTORS

2.2.1 Population Projections. In the post-war period one of Australia's major economic targets has been to stimulate the rate of population growth. An assisted migration programme has supplemented natural increase resulting in an average growth rate of about 2% per year, declining, however, below that level over the past several years, partly because changing social attitudes have caused a significant decline in natural increase.

Economic problems in the past two or three years have also resulted in a suspension of the assisted migration programme. As a consequence, population forecasts which, little more than a year ago, envisaged a population of about 22 million by the year 2000 have had to be quite substantially revised. The recently released report of the National Population Inquiry (Borrie Report) refrained from making any specific forecasts, but rather offered a number of alternative projections based on certain assumptions about migration and natural increase. No early reversal of the declining fertility rate is foreseen and the report makes certain calculations on the assumption that in the next few years it will decline to a point where it will just suffice for the population to replace itself in the long-term. There would, however, continue to be some gain from natural increase because of the age distribution of the existing population. This shows a predominance of people in the lower age groups owing to the higher fertility rate of earlier years and the population gains due to past migration. Nevertheless, the decline in fertility together with a gradual ageing of the population, will eventually result in immigration becoming the major factor in the rate of population growth. The net gain through migration for the year ended 30 June 1974 was 73,000, but this level may not be sustained in future years with the suspension of the assisted migration programme.

There are advantages of an increase in population by means of migration in that migrants, or at least a proportion of them, are capable of making a direct contribution to the work force compared with the growing-up period involved in the case of natural increase. In addition, selection procedures can ensure that—within reason—it is possible to choose people in particular work categories who possess the degrees of skill required to overcome specific shortages in the present work force. In recent years, there has been an average annual net gain of about 20,000 permanent arrivals independently of assisted migrants, so that net migration seems unlikely to fall below this level in future. In fact, it seems on the whole more likely that within the reasonably near future some recruitment of immigrants will be resumed, even if on a modified scale.

Allowing for possible future changes in immigration policies a reasonable conclusion from the Borrie Report is that the population in the year 2001 could vary between 16 million and 22 million, representing an average growth rate of between 0.7% and 1.9% per year. From within this range, an intermediate figure of 18.7 million has been adopted for general use in this (NTP) Report as a likely outcome.

2.2.2 Age Distribution of Population. Factors such as the age distribution of the population and the entry of more women into employment may be expected to counter the adverse effect of the lower birth rate on the level of economic activity.

Appendix I to this Chapter is a chart prepared for the World Population Conference held in Bucharest in 1974 showing an age-sex profile of the Australian population at 30 June 1973. The median age is only 28 years. The reduced fertility of recent years and migration have already caused the pyramid to assume a nearly vertical outline in the vicinity of its base. While the present trend will lead to an older population structure, it also means that, for some years to come, the decline in fertility will not be felt in the numbers reaching employable age. According to the Borrie Report, a decline will occur between 1978 and 1983 and again after 1986.

Since population changes will also have an impact on consumer demand, the reduced labour supply need not result in a shortage of labour but, should this occur, it may well be met by an increasing number of females joining or re-joining the labour force.

Increasing female participation has been a significant feature of the employment market in recent years.

2.2.3 Labour Force Projections and the Supply of Labour. The population level and its distribution by age imposes an obvious upper limit to the supply of available labour, though there are other factors which are important in determining the actual supply within that limit. The labour supply is, in turn, a very important determinant of the total level of economic activity, except in those periods—comparatively brief in post-war Australia—when there is clearly a situation of substantial involuntary unemployment.

Projections of the labour force over the period between the last census year 1971 and 2001 appear in the Borrie Report. They are calculated on the basis of official labour force surveys to 1973, and projected work force participation rates between 1973 and 2001, using two assumptions:

- that there is no change in the rate shown in the 1973 survey; and
- that some increase will result from the changing role of women in society.

Assuming, further, a net migration gain of between nil and 50,000 per year, an average annual growth of between 1.0% and 1.6% per year may be expected to occur between now and the end of the century.

With a given labour force the aggregate supply of labour is limited by the extent to which individual workers are willing to participate. Some, for instance, take on second jobs; whereas others are content to undertake less than full-time work. Even among the majority who have single full-time jobs there is scope for variation in the amount of overtime they are prepared to undertake. In addition, there is in this country considerable support among workers for efforts to obtain reductions in the standard hours of work. Presumably the comparative level of affluence is such that they are prepared to take some of the fruits of higher productivity in the form of increased leisure. The validity of such a choice is undeniable, but the effect may be to limit the potential for further productivity gains, unless these can be achieved by other means, such as improving technology or more efficient management methods.

In practice, there will normally be some scope for more effective use of the labour supply by better management of the employment market. There is, for instance, at all times some recorded unemployment even in a period of nominally full employment. Very little of this involuntary unemployment is due to any basic shortage of employment opportunities. Some, for instance, is seasonal in character and some due to 'frictional' factors; for example, the lag between termination of one job and the location of suitable employment elsewhere. Much of this kind of unemployment can be overcome by measures to increase the geographical mobility of workers and by schemes to re-train workers where necessary to increase the individual's range of job opportunities.

2.2.4 Geographical Distribution of Population. All states have shared in the relatively rapid population growth of the past thirty years. The rate of natural increase has varied little as between states but Tasmania and Queensland recorded slightly higher rates. Coincidentally, these two states gained less from overseas migration.

The most significant feature of internal population movement has been the continued drift from rural areas and small towns to major urban centres. There is also some drift from the smaller capital cities to Sydney and Melbourne.

Economic factors, in general tend to promote urban growth at the expense of rural areas, but there is ultimately a point at which the penalties of excessive congestion outweigh the advantages of large centres. The penalties and advantages are, however, often external to the economics of those (often businesses) who make the decisions affecting the direction of growth. Decentralisation, therefore, as a counter to the uncontrolled growth of capital cities depends heavily on official Government support, and this has been growing in the past few years. Plans exist for the development of several regional growth centres throughout Australia, but recent revisions of population growth estimates, culminating in the issue of the Borrie Report, will no doubt force a re-consideration of at least some of these projects, particularly those remote from existing populous areas. However, two projects, Albury-Wodonga and Bathurst-Orange, which are designed to relieve the pressure of growth in Melbourne and Sydney, have progressed beyond the planning stage and are unlikely to be affected. Several others, which represent extensions or satellites of existing cities will also proceed, although their rate of progress may be slower.

The extent to which future population growth might be diverted from existing major urban areas to regional growth centres was outlined by the Cities Commission in its 1973 Report to the Australian Government. That Report suggested targets for these seven centres, involving a total population growth of 1.1 million in the 30 year period 1971 to 2001. This figure would necessarily be reviewed in the light of the Borrie projections of total population growth, but Bathurst-Orange and Albury-Wodonga account for 0.5 million, or half of the total expected growth, and these projects are expected to continue.

The Cities Commission has more recently issued its Lutsanc Report (Land Use and Transportation Systems Alternatives for New Cities), which outlines a number of possible structural forms that new cities—those which can be planned from the outset—might take. The Report was based on 'an evaluation of current social trends in housing, work, education, leisure, recreation, socialising and health and welfare'. The city types suggested were designed to take advantage, where appropriate, of expected future technological developments, particularly in the fields of transportation and communications.

It seems probable that regional development, particularly if planned to exploit new and developing technology, will bring with it increasing demands for communications services. Additionally, decentralisation of population, industry and commerce over a larger number of urban locations, particularly where the centres are appreciable distances apart, will almost certainly increase the flow of long-distance telecommunications traffic. For example, the proposed establishment of a major population centre, based on exploitation of mineral deposits in the Pilbara region, in Western Australia, would have an appreciable effect on the level of trunk traffic between it and Perth, and also to the eastern states.

2.3 FUTURE OF ECONOMIC GROWTH

2.3.1 Population and labour force statistics are important indicators of overall growth potential, but are not in themselves adequate indicators of the extent or even the direction of economic development. A much more informative measure is the level of Gross Domestic Product (GDP). This is defined as the total value of goods and services produced in the economy, after deducting the cost of the goods and services used in producing them.

GDP is thus the indicator which is used to sum up in one measure the net effect of all economic activity. According to this measure, Australia has, until recently, experienced a long period of consistent growth, but it would not be safe to assume uncritically an indefinite continuation of this trend. A wide range of factors interacting together determine the course of the economy. There is a growing body of evidence to suggest that changed societal attitudes will increasingly influence the future economic structure of society. Some of the most significant social trends which play a part in determining the course of the economy are:

- the increasing complexity and the growing level of turbulence in society
- changes in preference between leisure and work
- changed consumption and investment patterns
- attitudes towards population growth
- environmental concern
- changes in women's and men's roles

Other factors may also be expected to exert a growing influence on the economy. The interaction of powerful institutional forces like trade unions and large business organisations, particularly the multi-nationals, and their influence on Government economic policy could have a crucial effect. International factors such as the supply and price of major resources, notably petroleum, will also be significant.

The often conflicting aims represented by these various forces in society may be at least partially reconciled by means of technological development, provided it is appropriately directed and applied. One step in the reconciliation process is represented by recent proposals for the development of social indicators as a measure of progress towards a variety of desirable social and economic objectives. At a meeting of the OECD Council in 1970, Ministers representing member countries discussed the subject—'Economic Growth—Quantitative and Qualitative Objectives for the 1970s'. They concluded that:

> 'growth is not an end in itself, but rather an instrument for creating better conditions of life' . . . 'increased attention must be given to the qualitative aspects of growth, and to the formulation of policies with respect to the broad economic and social choices involved in the allocation of growing resources.'

As one important initiative towards that end, it was decided to explore the possibility of developing a set of social indicators with the general objectives of:

- identifying the social demands, aspirations and problems which are or will likely be major concerns of socio-economic planning processes
- measuring and reporting change relative to these concerns; thus
- better focusing and enlightening public discussion and governmental decision-making

A Special Working Party on Social Indicators was set up with instructions to undertake this task. As a result, in 1973 OECD issued a list of social concerns common to most member countries as the basis for the development of a system of social indicators. The Australian Bureau of Statistics has begun work on producing such a set of indicators, using the OECD list of social concerns as a basis.

The net effect of current and future economic influences on the future growth of the Australian economy can be gauged only in general terms. However, some estimates in terms of the expected rate of growth of GDP are needed to assess the extent to which it will be able to provide the resource requirements of a growing telecommunications industry.

2.3.2 Forecast Based on Past Trends. Expressed in real terms (i.e. after adjusting for differing price levels) GDP in Australia has recorded an average increase of about 5% per year over the post-war period. Over the same period, population has increased at nearly 2% per year, giving an average net GDP increase per head of just over 3% per year—as recorded in the official publication, Australian National Accounts.

Most forecasts of GDP are in the three to five year range, and they tend to be fairly sensitive to events occurring or imminent at the time of the forecast. These movements would be very substantially of a cyclical or temporary character when viewed in the context of the time-span with which this Report is concerned—the twenty-five years between now and the year 2000. It is evident that only very generalised estimates can be made with any degree of realism for such a period in the future, but such estimates do not need to follow the vagaries of short-term fluctuations.

Independent forecasts were made by two economic consultants to the then Australian Post Office of the growth of GDP for the years 1975–76 and 1976–77. One consultant puts the growth rate at 2.2% and 5.6%; the other, at 4.5% and 4.0%. Both estimates could perhaps be defended by reference to current events, but the variation in the estimates illustrates the difficulties of short-term forecasting that stem from a multiplicity of relevant factors, many of which have quite contrary influences.

In all probability, longer-term forecasts will prove to be more reliable, but very little work of this kind has been undertaken in Australia. The only known forecasts of this kind have been produced by the Melbourne University's Institute of Applied Economic and Social Research. This group has developed an econometric model of the Australian economy by means of which it has produced long-term (ten-year) forecasts of real GDP per capita. Input for the model is supplied by means of a number of variables, external to the model, in some cases representing the Institute's judgement of likely future developments and in other the views expressed by specialists in particular fields. These inputs include factors such as population (migration and natural increase), world trade patterns, wage levels, Government expenditure and interest rates. The latest forecast produced from this model was that real GDP per head of population in the next 10 years would show an average increase of 2.6% per year. This suggests a somewhat slower growth rate than that of the last 10 years or more, which averaged a little over 3% per year.

The forecast may be on the conservative side in that it reflects the influence of economic developments in the last two years which have substantially restrained the level of economic activity.

2.3.3 Influences in the Direction of a Lower Growth Rate. In common with the experience of other countries of the Western world, new attitudes towards purely material improvements are appearing in Australia. There is a growing disenchantment with the traditional quest of a rising GDP as the major objective of economic life. Whether or not these attitudes are a cause or effect of present economic conditions, it is true that recent developments point to a possible slowing in economic activity, and this may prove to be a long-term trend rather than a passing phenomenon.

The present high level of inflation, although high even by world standards, is clearly not peculiar to this country and could prove to be persistent. Experience in many parts of the world has shown that the wage-price spiral can be difficult to control. In this country, trade union organisation is relatively strong and pressure for wage increases difficult to resist. Should inflation persist at a higher rate than that of our principal trading partners, the maintenance of exports would be affected, with adverse results for the balance of payments. The suspension of assisted migration would be felt initially, with the lower birth rate assisting its influence progressively in later years. A consequential effect of inflation would be to discourage the inflow of foreign investment for developmental works. There would almost certainly be persistent unemployment, probably increasing beyond the present level of about 5% of the work force.

Should all these possibilities eventuate then the rate of growth of per capita GDP could progressively decrease from the average of past years (in the vicinity of 3.3% per year) to perhaps half that rate.

2.3.4 Influences in Favour of a Higher Growth Rate. Present economic indications taken alone give little grounds for expectation of an increasing rate of growth in the economy, but it would be unwise to disregard the possibility in the long-term. In the same way that social attitudes would seem to be adverse to high growth, technological developments offer prospects of a compromise between maintenance of moderate economic growth and social aspirations for an improved quality of life.

Although the past few years have seen a pause in developmental works, particularly projects to exploit known mineral resources, their long-term viability is reasonably well assured. The history of economic development in the past has been that new technology has provided the improved productivity needed to permit simultaneous advances in social welfare and material benefits. There is no logical reason to exclude the possibility that economic growth in terms of increasing GDP per capita may reach new heights in the years ahead. In this country, in particular, there exist opportunities for the application of improved technology to this end. Its natural resources include substantial deposits of practically all types of minerals and sources of energy. Plans for development of many projects could be implemented at short notice as soon as improved methods of extraction and refinement can be developed.

Past experience of this and other comparable countries suggests that, even with a combination of favourable factors, the growth of GDP per head would probably not exceed 4.5% per year.

2.3.5 The Most Likely Long-Term Economic Future. The essential stability of the Australian economy has been demonstrated over many years. The rate of GDP per head has varied only between 3.0% and 3.5% per year between 1961–62 and 1971–72. This level of growth appears to be quite practicable for most of the advanced countries, many of which have not nearly as great natural resources as Australia. The existence in this country of very substantial mineral resources and fuels has been a considerable source of support in a period of inflation and rising unemployment. Domestic production of a substantial proportion of our petroleum needs has insulated the country from the worst effects of rising world oil prices, whilst exports of coal and minerals have so far ensured a fairly high level of international trade and balance of payments. So far as can be foreseen, overseas markets for these products appear to be reasonably assured so long as the internal inflation rate does not have the effect of raising production costs too much.

On balance, it would seem to be within the country's capacity to maintain a moderate long-term rate of economic growth within much the same range as that achieved in the previous 10 years or so. This would seem to be more typical of our future potential than the results for the last two years, during which time very little real per capita increase has occurred. A reasonable estimate of long-term per capita GDP growth would be in the region of 3% per year, although the level for individual years may well vary considerably.

It is, nevertheless, important to consider the possible consequences of a persisting failure of the economy to match these expectations. Judging from recorded results of years in which economic problems disrupted normal progress, including particularly the last year or two, it is at least possible that the long-term growth rate could be as low as 1.75% per year; but this is regarded as very unlikely. In the upper direction, if the results achieved in the best years of the past were to be consistently achieved in the future, a feasible upper growth limit would be about 4.5% per year. Again, this is not very likely.

The range of possible levels of total GDP for some future year can be estimated approximately given the likely rates of growth of population and real GDP per head of population. On this basis it is suggested that, in the year 2000, GDP (at 1972–73 prices) would probably lie between $120,000m and $200,000m with a most likely level of about $160,000m. For the year 1974–75 GDP is estimated to be in the region of $50,000m. All figures have been expressed in constant prices (base 1972–73) to facilitate comparison with cost estimates in other chapters.

2.4 TELECOMMUNICATIONS IN A POST-INDUSTRIAL SOCIETY

2.4.1 Industrial Demand. In addition to the overall level of economic development as represented by growth in GDP, there will be other factors helping to determine the role of telecommunications in future society. In particular, developing and expected structural changes in the economy will play an important part. In the past, technological developments and management efficiencies have achieved great economies in use of resources in primary and secondary industries. Increasing affluence in the supply of physical goods permits the application of more resources to the tertiary sector, and it has grown accordingly. By 1970–71, this sector had accounted for more than 50% of GDP and the proportion continues to grow.

In general terms, the tertiary sector comprises those industries which provide non-material services such as transportation, education, health and business facilities. The particular characteristic of those industries—one that is significant for the telecommunications industry—is that a much higher element of information transfer is involved in the activities concerned. This trend is not limited to the service sector of the economy, though it may be more readily evident there, particularly with the present day emphasis on the importance of educational, social and cultural aspects of life. In the industrial sector, for instance, there is a tendency towards greater automation with a higher number of workers engaged on activities like design, production control, management and clerical activities, while the manual work force tends to be reduced. Advancing technology of all kinds has contributed to this development, but obviously the advent of computers with their virtually unlimited capacity for generating, processing and storing information has been a key factor. In turn, computers have made and will continue to make increasing demands for telecommunications services to facilitate transmission of information so generated. An expanding demand for, and supply of, information is extremely important to the communications industry and telecommunications in particular. It has been said, with some justice, that communications is related to the handling of information in the same way as transportation is to the handling of goods.

The view that production, storage, processing and transmission of information will become an essential element in economic and social development has given rise to proposals for formal international co-operation of member governments of OECD in the field of computers and telecommunications. At the OECD Conference on Computer/Telecommunication Policy, held in February 1975, the concept was advanced of an identifiable 'information sector' of the economy, representing a fourth sector distinct from the traditional agricultural, industrial and services sectors. This new sector is seen as that embracing activities in which information handling is the predominant characteristic, and would thus cut horizontally across the present sectoral boundaries. Although a full statistical evaluation of the sector would be difficult, emerging interest at the international level in the concept of an information sector as a distinct entity indicates the potential importance to the economy of current developments in this area. Preliminary work in the USA on such a four-sector dissection of the labour force by occupations—using the criterion of type of work performed—shows that the greatest increase has occurred in the information sector. This now accounts for over 50% of all employed persons, having grown from about 30% in 1960.

The scarcity of quantitative data on the extent and direction of this trend in Australia is an obstacle to long-term telecommunications planning. For this reason, NTP commissioned a study of the information industry by the Economics Department of the Queensland University under the guidance of Professor D. M. Lamberton. In this study, data from Australian censuses since 1911 was used to classify the Australian work force into each of the four proposed economic sectors—agriculture, industry, service and information. Two separate bases of classification were used—the first according to occupation and the second by industry. The occupational approach classifies people according to the type of contribution they make to the production process, independently of the product. The industry approach classifies people according to the product which they help to produce, independently of their actual occupation. Hence, according to the occupation approach, a clerk in a glue factory is classed as an 'information worker' but a cleaner is not, whereas, in an industry approach, a cleaner in a school is classed as belonging to the information industry, but the clerk in the glue factory is not. Interim results reveal the same trend as that observed in the United States although rather less advanced. The analysis by occupation shows that the proportion classified to information grew from 8.5% in 1911 to 27.5% in 1971, while the industrial classification recorded an increase from 8.7% to 19.1% over the same period.

This evidence suggests possible future developments in society will shift the main emphasis from production of physical goods to production of information. The implications would be important for all facets of society, but certainly the economic consequences alone would be profound. It is argued by some authorities that certain characteristics of information, as a commodity, could render present economic theory and organisation obsolete. Some of these characteristics are the essential uniqueness of each separate piece of information, the lack of any satisfactory unit of quantity as a measure, and the fact that information may be sold, perhaps many times, and yet remain in the possession of the seller. The traditional economic theories of value would need to be substantially revised to meet these changed circumstances. Growing problems of property rights in information would also demand a body of regulation far beyond the present laws of patent and copyright. An even more fundamental question is whether, in view of the peculiar nature of information, the competitive strategies on which existing economic systems are based could long survive in their present form.

As previously mentioned, growth of the information industry has been greatly accelerated by the availability of computers for use wherever generation, storage and access to data is needed. Business management in government and industry has increasingly resorted to their use, giving rise to new demands for telecommunications services. It is becoming increasingly clear that the complementary character of computer facilities and telecommunications services will generate a mutually reinforcing demand.

2.4.2 Domestic Demands. The trend already noted towards reduced hours of work should also generate a domestic demand for services which will give access to sources of knowledge, education and entertainment. The ability of the average household to pay for services is, of course, an important factor. This aspect is discussed in more detail in Chapter 10. It is concluded that, in general, average incomes—currently (1974–75 prices) in the region of $8,000 per employed person per year—would contain a discretionary element of sufficient size to permit many households to subscribe for some form of telecommunications service additional to the telephone. It is of importance in this connection that about 60% of all households have a telephone at present. In recent years, the existence of a telephone service in the home has tended to become the norm, and to be regarded as a standard entitlement in the same class as services such as electricity, gas, water and sewerage. In the context of a future where a variety of educational, informational and similar facilities would be available in the home as adjuncts to the basic telephone service, the interests of social equity may well demand that all households should have access to them. Conceivably, social pressures could, in time, result in some form of Government subsidy to lower-income households. This would greatly stimulate the domestic demand for telephone services, and the possibility must therefore be seriously considered. Demand estimates are discussed in greater detail in Chapters 8 and 10.

2.4.3 International Telecommunications Services. The already high growth rate of demand for these services will no doubt be accentuated by contemporary changes in the direction and emphasis of international trade. In the post-war years, Japan has become our largest trading partner and the volume of business transacted with China and other countries in the Asian region has increased very greatly. There is every reason to expect that our trade relations with this part of the world will continue to expand, possibly to the point where closer ties in the general nature of an EEC-type alliance could develop, giving rise to greater demand for international telecommunications facilities. Other stimulants to growth of international traffic include Australia's high level of overseas-born residents and the continuing improvement in facilities for international travel and transportation.

2.4.4 Capital Needs for Telecommunications Services. One of the major problems facing the telecommunications authority in developing new services is the extremely large and increasing amounts of capital that will be needed. Demand for existing services remains strong and, although the normal telephone service will continue to be the dominant element of the Australian telecommunications system for many years, the progressive introduction of the newer-type services referred to in Chapter 8 will generate a growing need for investment funds. Annual capital investment on these services will become an increasingly significant proportion of total investment, helped by a declining telephone growth rate as penetration of the domestic market increases.

Possible levels of demand for each of the various services are discussed in Chapter 8, entitled 'Telecommunications Growth and Service Prospects'. Both upper and lower limits of demand are suggested for each service, and the likely cost of providing the services is also estimated. To facilitate comparisons, all money amounts in that Chapter are expressed in constant dollars, with the year 1972–73 as the base. Corresponding to demand limits, upper and lower bounds of capital expenditure are suggested for the period from 1975 to the end of the century. For the year 2000, an amount of $900m is likely as the lower bound and $2700m for the upper limit. The average annual growth rates of capital implicit in these limits would be 2.5% and 7% respectively.

A specific demand level for each of the various services cannot be named with any real confidence, but it is unlikely that there would be a coincidence of either upper or lower limits for all services. A spread of demand among them seems most likely in view of the high degree of substitutability between those providing similar facilities, e.g. telex, data and facsimile. For practical purposes it is assumed, not unreasonably, that there would be an intermediate level of demand requiring a capital expenditure of $1500m to $2000m in the year 2000, corresponding to an annual growth rate of 4.5% to 5.5%. The question arises whether the range of capital expenditure envisaged for the telecommunications service would be within the capacity of the economy to sustain. This will depend of course on the rate of economic development.

Principal indicators of economic development are the level of output as measured by Gross Domestic Product (GDP) and the rate of new investment represented by Gross Fixed Capital Expenditure (GFCE). The latter is indicative of the extent to which the economy as a whole is able and willing to undertake new investment out of the total productive resources as represented by GDP.

The two indicators are very closely related but the relationship is quite complex. To some extent, individual investment decisions are made and funded independently of the internal economy, and in this way they help to determine the level of GDP. In the aggregate, however, total investment is made up of many separate decisions, mostly influenced by the state of the economy, and largely dependent on it for finance and physical resources. In this way GDP is in turn an important determinant of GFCE. In practice the relationship has been reasonably constant, with GFCE varying between 23% and 27% of GDP over the post-war years. A reasonable estimate for the future is that about 25% of GDP will be devoted to new investment. The actual level of GDP and GFCE will represent the extent of total resources out of which telecommunications investment will have to be financed.

Earlier in this chapter, it was estimated that, by the year 2000, GDP would be within the range $120,000m to $200,000m with a likely level in the vicinity of $160,000m. In the recent past, the level of telecommunications investment has represented about 1% of GDP (or 4.5% of GFCE). Given a continuation of this share of resources, funds potentially available for telecommunications in the year 2000 may be estimated at around $1200m to $2000m.

Comparing this estimate of available capital funds with the likely range of telecommunications needs, i.e. between $900m and $2700m, it appears that difficulties in financing investment plans are likely to occur only in the event of the upper level of demand being approached. Even this, however, is not necessarily so. The upper demand levels postulated for the telecommunications industry were estimated in the light of current and expected future technological and social trends which would give it a higher growth rate than that of the economy generally. It is reasonable to expect that this would be accompanied by a tendency for the industry to attract an increasing share of total investment funds. Such a trend has been observed in the past, with the telecommunications share of GFCE increasing from about 3% to 4.5% over the last ten years. A continuation of this trend would seem to be feasible without making any adverse impact on the economy as a whole. Probably a progressive increase over the next twenty-five years to 6% or possibly 7% of GFCE would be quite practicable if the level of demand warranted it.

In summary, therefore, it would appear that, at the lower or intermediate levels of telecommunications demand capital requirements can be met with no appreciable increase in the present share of total investment resources, while the needs which correspond to an upper demand level could probably be accommodated with an economically manageable increase in that share.

2.4.5 Potential Savings from Telecommunications Investment. A higher rate of investment in telecommunications will not necessarily increase the economy's need for capital funds appreciably, or even at all, beyond what they might otherwise be. It would, for instance, provide services capable of obviating the need for capital expenditure elsewhere, e.g. transportation services. An added benefit would be associated savings in operating costs plus a conservation of time and energy resources. As an instance of this, the concept of the home office, by which improved communications facilities might allow many people to work at home rather than commute daily, is now familiar. Whether this becomes a reality will depend on many factors, but the simple economics of a home office are attractive. A recent NTP study found that it costs around $3000 per city worker per year in office accommodation costs, fares and travelling time. The annual charges on communications facilities needed to save this expenditure could be substantially less.

Although Australia is reasonably well endowed with most energy resources, its known reserves of petroleum are very slender. Only 70% of the country's needs are domestically produced; even at the current rate of usage, known reserves will be exhausted during the 1980s and prospects for major new discoveries are uncertain. As is well known, the oil crisis has raised the price of imported petroleum enormously in recent years. Telecommunications services by their very nature have the capacity to render unnecessary an appreciable proportion of the commuter-type motor car journeys, and could achieve a substantial reduction in petroleum needs.

Telecommunications services also have the potential to improve the productivity of industries using them. The Report of the OECD conference 'Computers and Telecommunications (Paris 1973)' referred to the development of joint computer/telecommunications systems as the second industrial revolution. According to the report, educational services seem to offer the greatest long-term promise, but very substantial gains are possible in many other fields also.

2.5 CONCLUSIONS

From this background the following conclusions emerge:

1. Long-term planning ought not to be unduly influenced by the transient factors which often dominate the short-term economic outlook.
2. The advent of an information-based society would make the whole community dependent on the operation of the telecommunications network. Information would have to be treated as a commodity in its own right. New concepts of production and measures of economic performance, both within the telecommunications industry and externally, would have to be developed. Revision of economic theory may also be necessary to encompass these new concepts of value.
3. The most likely growth projection is an annual increase of 3% in per capita GDP (within possible limits of 1.75% and 4.5%), and a 1.1% population increase (within possible limits of 0.7% and 1.9%).

The implications for future telecommunications investment are:

(i) With economic growth at or near the lower limit, telecommunications growth might consist of no more than a modest expansion of the telephone network together with a minimal development of other services.

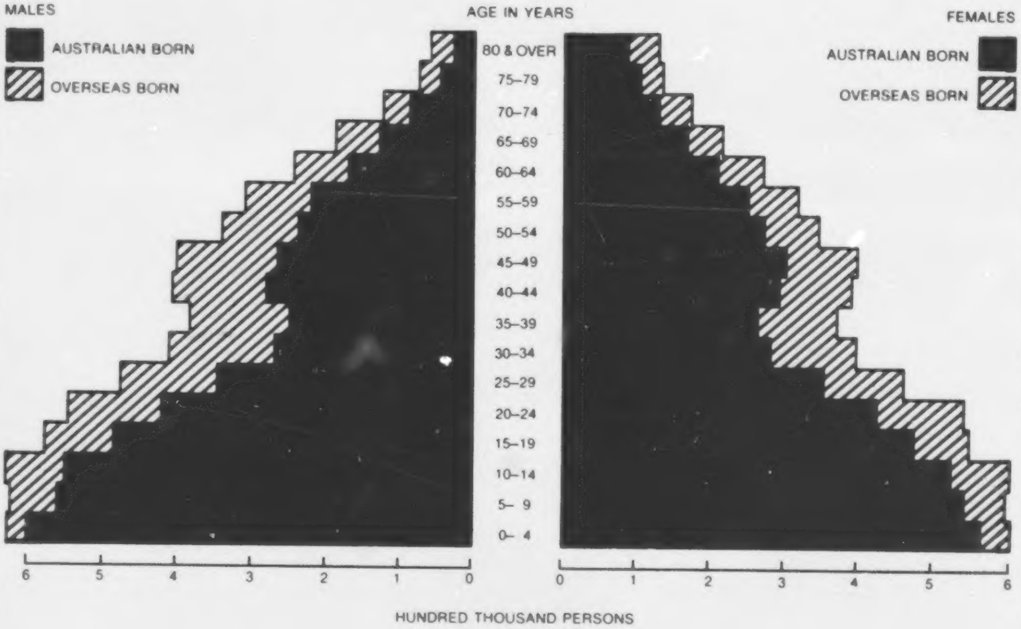
The amount of investment required would represent about 3% of Gross Fixed Capital Expenditure, which is less than the present telecommunications share of 4.5% but this is considered an unlikely outcome.

(ii) A progressive implementation of new services, corresponding to the intermediate level of economic growth and of telecommunications demand, appears economically feasible. This would require the telecommunications share of GFCE to be maintained at around 4.5%.

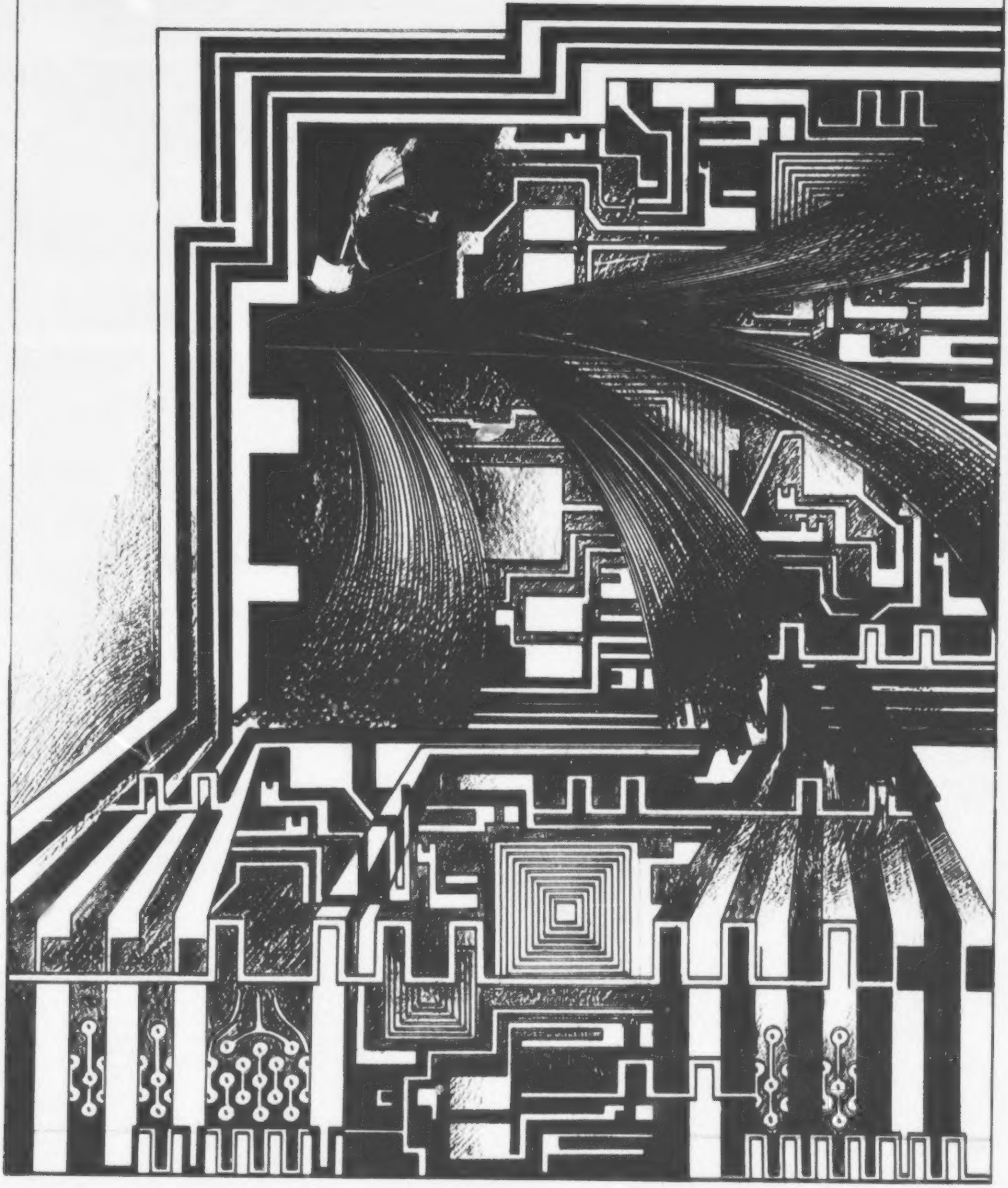
(iii) An increasing intensity of demand for new types of services coupled with a strong economic growth rate would require the telecommunications share of GFCE to increase at about the same rate as it has done in the past, raising it from present 4.5% to around 6% by the year 2000. This would still be practicable.

APPENDIX 1

Age–sex profile: Australia, 30 June 1973



3. TECHNICAL FUTURES



3.1 INTRODUCTION: APPROACHES TO INNOVATION

Before dealing with the major technical innovations ahead, we should first try to define our overall stance towards the introduction of new technologies to satisfy network needs. One view holds that, because of Australia's limited resources, small population and relative insulation from other advanced countries, we should not strive to be first in the field. Rather we should monitor the experience of others and adopt only those new technologies and services that have been well tried and tested abroad.

The opposing view is that size is no barrier to innovative excellence (e.g. Sweden and Switzerland) and that we should identify and pursue definite technological goals so that in selected areas we may become world leaders. In telecommunications there is the supporting argument that, as a monopoly, we have a special obligation to stay in front, otherwise customers are denied access to advanced services which, as in USA, competitors might provide.

An intermediate view is to maintain a research and development capability that keeps us in the vanguard of knowledge, and where specific opportunities present themselves, to follow these through. This is unlikely to result in many 'firsts' but we should not be too far behind the leaders. This would seem to have been our philosophy over the past few decades. It has paid good dividends and we would be unwise either to attempt to expand simultaneously on too many new fronts or to withdraw to an unduly conservative and cautious position. We should ensure that we retain the capability to implement innovative technology which suits Australia's particular network development, economic and social needs, and where we judge that the net potential advantages outweigh the inevitable risks.

3.2 FUTURE TECHNOLOGIES

3.2.1 Emerging technologies identified as having the greatest potential for development of telecommunications over the next twenty-five years are those associated with:

- computers
- digital communications (both voice and data)
- wideband distribution media
- mobile radio
- satellites

3.2.2 Computers. The increasing use of computers for control of switching equipment, as well as in teleprocessing, is expected to accelerate dramatically. Major trends are towards higher processing speeds, greater storage capacity, reduced energy and space requirements and continuance of the falling unit processing and storage costs experienced over the past two decades. This will result in wide availability of dispersed processing power to serve decentralised offices and eventually homes. This implies increasing reliance on the subscribers distribution network for remote terminal access to central computing facilities, and the long-term capability of the network to provide the required degree of access must be examined. The range of computer terminal devices will proliferate and, whilst cost reductions can also be expected, terminal equipment costs will represent a larger proportion of total computer costs than at present.

Computer control of switching equipment should bring reduced capital and operating costs of exchanges, greater flexibility in network organisation and a wide range of subscriber facilities, more closely tailored to individual needs, at low incremental costs. This could have great significance for the future, firstly in providing profitable new services, and also in making the system less monolithic and 'mass-produced' and more individualistic from the user's point of view.

It now seems likely that from about 1980, computer controlled subscriber exchanges will be used in Australia to help meet the growth and development of the telephone network. Computer controlled switching is already in use in parts of the trunk and data networks.

3.2.3 Digital Communications. There is now general world-wide agreement that digital transmission and switching is a desirable long-term goal for both voice and data telecommunication networks. Fully digital networks offer the following advantages:

- significantly cheaper switching and transmission
- improved transmission performance
- high degree of compatibility between various information streams, as both data and voice are represented by digital bit streams
- more readily amenable to bandwidth compression techniques, particularly for wideband services
- opportunity for telecommunications equipment costs to follow the falling cost curve of computer equipment, since digital devices are highly amenable to microminiaturisation and large scale integration of components (LSI) fabrication.

Digital transmission systems are already widely used abroad in junction and trunk applications. Several countries (Canada, Belgium, Italy and France) seem poised to commit themselves to fully digital networks, but it could be five years at least before the first commercially available systems will begin to be introduced for standard network development. Prior to that, however, it seems likely that digital switching will be introduced selectively into some trunk networks, pending decision on local and tandem switching.

There is some difference of opinion as to the viability of the introduction of digital techniques into the Australian network, and the geographical and demographic nature of Australia tends to militate against it. However, with the apparent quickening pace of digital developments overseas, and the potential growth of data and visual services in Australia, the economics may favour digital operation sooner than is generally expected.

3.2.4 Wideband Distribution Media. The subscriber distribution networks represent the largest sector of telecommunications capital costs. There is world-wide interest in reducing these costs as there is in providing a capability for the transmission of signals of wider bandwidth than that required for the telephone. The technologies which have been considered include:

- shielded symmetric pair cables
- coaxial cables
- waveguides
- optical fibres
- SHF radio

Optical fibre is the most promising and exciting of the potential distribution media, but is also the one requiring the greatest development. While not dwelling on the yet-to-be solved problems of optical fibres, the following are the main advantages promised:

- basic materials (primarily silicon compounds) are plentiful and cheaply obtained
- transmission over distances of the order of 10 km without amplification, and offering bandwidths of 10 MHz per fibre or greater
- capability for cable TV broadcast services over the same cable used for telephone and other telecommunications services
- smaller cross-section than present wires, so that an existing cable could be replaced with one containing more transmission paths, and vastly more bandwidth capability

It is estimated that at least 10 more years of research and development will be required to produce a viable optical fibre subscriber distribution system. Thus 1985 to 1990 is the likely period during which the advantages of optical fibre could become available in local networks.

Optical fibres also show promise as an alternative to coaxial cable or radio in the long distance trunk network, and as a means of relieving duct congestion in high density business areas.

Super high frequency radio has also been mentioned as a distribution medium. This may be of particular interest where low penetrations of services are required and first-in costs of a cable distribution are prohibitive.

3.2.5 Mobile Radio. Mobile radio and allied questions of RF spectrum availability are dealt with in more detail in Chapter 4 and are discussed only briefly below.

Private (despatch) mobile radio systems are well established in Australia, and demand is high. A public mobile network with automatic access to the entire switched telephone network has not yet been established, although work to this end is in progress. Networks of this latter type have been established in recent years in other countries; the overseas experience suggests that there will be strong demand in Australia when the service is introduced here.

The technologies of mobile radio are moving to reduce the cost of vehicle-mounted mobiles; to reduce the size of mobile equipment, making a hand-held or pocket mobile unit a prospect within the next decade and to develop 'cellular' systems operating at UHF, to conserve spectrum.

It is considered likely that the trends in mobile technology could lead to a total demand by the year 2000 of some hundreds of thousands of mobiles, mainly in the capital cities. It is possible that spectrum conservation considerations would lead to an amalgamation of private networks with the public mobile system.

The UHF cellular mobile network is very economic with regard to spectrum usage. However, it is likely to involve considerably higher initial establishment costs, compared with present-day approaches to mobile networks. These higher costs are associated with the multiple antennae required to cover the total service area, and the computers and other control equipment required to locate a mobile in a particular cell. It is considered unlikely that viable cellular networks will emerge in less than a decade, and then in response to continuing high demand for mobile services and spectrum.

3.2.6 Satellites. Satellite technology is mentioned only briefly here as it is being studied in depth elsewhere within the Commission. However, NTP findings support the case for an Australian domestic satellite system in the early 1980s. This support stems from the desirability of introducing a video-conferencing facility between capital cities, extended progressively to selected provincial centres. This is seen as a viable strategy for introduction of video-services on a point-point basis, pending development of low-cost wideband media suitable for local network application, which would permit eventual extension of the service to subscribers' premises. A satellite will also provide solutions to rural communications problems.

3.3 NETWORK DEVELOPMENT TO THE YEAR 2000

3.3.1 Introduction. This discussion describes four approaches to the continued development of the network. They differ basically with respect to the information capacity (or bandwidth) available in the network and extended to subscriber locations; hence they differ in the range of services that each could support.

The network capabilities are identified as:

- basic telephone bandwidth network
- high-speed digital network
- 1 MHz videophone capability
- 5 MHz videophone capability

These descriptions are not intended as forecasts, nor should they be viewed as separate entities. Later it will be shown that they could be interlaced in time-sequence to form a cohesive strategy for flexible network development.

Forecast ranges of demand for telephone, telex, data, facsimile and videophone services are presented in Chapter 8, together with estimated capital costs. Selective use of these forecasts has been made in this discussion.

The costs for network development are speculative, but represent the outcome of trend studies, backed by expert opinion, about the cost reductions which might follow technological developments and efficiencies of scale. The figures have been quoted in constant June 1973 prices, and are meant to include distributed overheads, to be comparable with present published capital accounts.

3.3.2 Telephone-Bandwidth Network. The present network is designed basically for telephone operation, using frequencies up to about 4 kHz. Portions of the network are incapable of effective operation at frequencies beyond 4 kHz. Other portions, notably the subscriber distribution cables, are capable of some sort of operation at higher frequencies.

The transmission medium in the present network is mainly symmetric pair cables, although coaxial cables and radio are used for trunk and some junction circuits.

The transmission mode on both physical and carrier circuits is analogue. In the future, digital carrier systems will probably play a part in the trunk and junction parts of the network, and could conceivably supplant analogue carrier systems by the end of the century.

The switched datel service is integrated with the telephone network; other networks, e.g; telex, tend to be overlays. To date these overlays have, in the main, only involved the switching medium, sharing the transmission medium with the telephone network.

In the future, an overlay network may be required for cable TV broadcasts. This overlay will require a duplicate transmission medium capable of carrying a number (say 5–20) of 5 MHz broadcast TV channels. This medium could be a coaxial cable with repeaters, or a bundle of optical fibres, carrying one or more channels per fibre. In the areas where the new medium is provided, there is a basic choice of above-ground or underground reticulation. Above-ground reticulation is basically cheaper, but underground reticulation will carry little cost penalty if space is available in underground ducts and pipes provided for telephony cables. The penalties will be high if underground ducts, etc. have to be duplicated.

The services which can be supported by the 4 kHz network are very wide-ranging. Literally hundreds of services of a 'data' type (e.g. meter reading, information services, computer access, computer control, computer-aided education, remote shopping and banking) are possible, and only await commercial exploitation. The network could also support: medium-speed switched facsimile (about 1 minute per A4 page), interactive (answer-back) channels to complement broadcast TV services (whether off-air or cable TV), and slow-scan fixed-frame video.

The main switched services which the 4 kHz network cannot provide are: a real-time switched video service (videophone), and a high-speed facsimile service. Other possible telecommunications services requiring 'wideband' transmission may emerge if a suitable network is provided.

An important feature of the 4kHz network is its pervasiveness; services which it supports can be provided at almost any location in Australia at low incremental cost. Thus, the market penetration of any service has little effect on the network costs of providing the service. In the early history of a new service the network costs per service will be low, but as the service proliferates there will be few economies of scale.

The present telephone network caters for something over 3½ million subscribers. The replacement cost of this network would be of the order of $8 billion (billion = 10^9). Between now and the year 2000 a further capital investment of between $13 and $21 billion would be made in expanding the telephone network to between 8 and 11 million subscribers, respectively. This assumes that the telephone network remains basically as it is, technologically speaking. Additional capital expenditures would be involved in the provision of data, mobile, and CATV or CTV services. Costs for data and mobile services depend on demand levels. CATV distribution to all urban areas would require a capital outlay of about $2 billion by the year 2000.

3.3.3 High-Speed Digital Networks. As discussed previously, networks involving integrated digital switching and transmission may evolve overseas. These networks would probably be based on the 64 kb/s bit rate of an encoded PCM channel.

The transmission medium would continue to be symmetric pair cables, but the transmission mode would become digital in junction and trunk circuits. Digital mode transmission might also be adopted in the subscriber distribution part of the network, and this would enhance the provision of data and facsimile services. It is likely that digital operation at 64 kb/s to subscriber premises would require either an overlay of digital regenerators, or overlaid high frequency cables which would not require regeneration. These suggestions of overlay networks raise questions of manhole space for regenerators, and duct/pipe space for cables. Coaxial cable for CATV/CTV could also be competing for duct space.

The services which could be supported by a digital network are basically the same as for the 4 kHz network discussed above. However, a facsimile service of about 5 seconds A4 page capability could be supported if 64 kb/s data capability is extended to subscriber premises. This would leave a videophone service as the only one not supportable by the digital network.

If a digital network were introduced in, say, 1985, then at the higher level of telephone demand approximately half the network would be digital by the year 2000. If digital costs were 10% lower than analogue, this would represent a capital saving of the order of $1 billion in the 15 year period 1985–2000.

3.3.4 1 MHz Videophone Capability. The most basic videophone service, similar to the Bell 'Picturephone', requires a network with a transmission capability of 1 MHz or about 20 Mb/s, assuming that picture source encoding is not economically justified. Even with significant bandwidth compression, the transmission capacity required by the videophone is likely to be well in excess of that which could be provided by a digital voice/data network such as that discussed above.

The transmission medium could be symmetric pair cables, with repeaters at about 1 km spacing (as with the Bell picturephone), high frequency pair cable, coaxial cable, or optical fibre cable.

The transmission mode might be analogue or digital. The digital mode would only be appropriate with coaxial or optical fibre cables, or in the trunk or junction network if digital carrier systems were adopted. For short-haul working a digital transmission mode would probably have to be matched with digital switching, to avoid excessive analogue-digital transformations.

The transmission network could be an overlay, or conceivably the same cables could, unrepeatered, serve all requirements from telephony to video-telephony. This non-overlay situation could be exemplified by a network wherein optical fibre cables had replaced pair cables. Because of the very different switching requirements, the wideband switching would probably be overlaid on the telephony switching. The latter could, of course, be either digital or analogue. An overlay network raises the problems, discussed before, of housings for repeaters and underground duct space for added cable sheaths.

The wideband network could support a very high-speed facsimile service as well as videophones.

The main effect of market penetration would be on the ability to place the subscriber distribution plant in limited street easements. A low penetration wideband service could use repeatered pair cables, or coaxial cables, with minimal extensions to manholes or ducts. However, as penetration increased to the levels of the telephone service, the manhole and duct requirements, and the costs of frequent ground-opening, would become an uneconomic burden. An optical fibre distribution is the only one consistent with possible high demands for service while utilising available duct space. Optical fibre distribution could simultaneously provide CTV distribution at low incremental cost. There is also the prospect of providing basic telephone service on optical fibres, moving on completely from metallic conductor cables.

The cost estimates for a wideband network vary widely with demand and the technology used. An extensive, high demand wideband network based on coaxial cables might require a capital outlay of well over $100 billion, plus the cost of terminals. The same network, provided by means of optical fibres, could cost less than $10 billion. Advanced terminal devices required for the network (videophones, facsimile machines, VDU's etc.) would add many billions of dollars to the network costs.

On the other hand, low penetration networks, say serving the central business districts of the capital cities, could be established with capital outlays of $5,000–$10,000 per subscriber (including terminals), more or less irrespective of technology employed. (The corresponding all-up figure for an average telephone service is around $2,500). The extent to which inter-capital trunk traffic is catered for has a much higher influence on wideband network costs than on those for the telephone network.

3.3.5 5 MHz Videophone Capability. One of the criticisms of the Bell Picturephone is the relatively poor picture quality. Conceivably, a picture standard consistent with broadcast TV could have greater market success.

The distribution medium for such a service would probably have to be a special cable. With this proviso, the discussion of a 1 MHz network applies in this case also.

3.3.6 Summary of Costs. The estimated costs of network development range from $10 billion to well over $100 billion depending on levels of demand, and whether or not a wideband network is established. However, the costs are by no means directly proportional to network complexity. A wide range of alternative network developments can be achieved within a ± 10% range of the cost of providing a basic telephone network, given the developments of key technologies which have been assumed. Only very high demand wideband networks are likely to require significant transfers of national resources to telecommunications.

3.3.7 Most Likely Future of Network Development. The first step might be to move selectively into digital networks. Digital trunk and junction transmission could be introduced by the early 1980s, and digital data and voice local networks commencing around 1985. The integration of voice and data networks may then commence from 1990 onwards.

It is thought likely that metallic symmetric pair cables will be retained at least to the late 1990s for the basic network, with overlays being developed for advanced services. Coaxial cables will be used initially to provide CATV services to areas of poor off-air reception, but are unlikely to penetrate far into other urban areas. These cables could support development of information retrieval/display systems but, because of their basic unsuitability for a long-term wideband network, coaxial cables are not likely to be used for switched wideband services, except in experiments or field trials.

By 1985, system-oriented development of optical fibre cables could permit the beginnings of a switched wideband subscriber network. Wideband services would find their early markets mainly in the capital city central business districts. Optical fibre cables would overlay conventional cables, and could be used as a means of bringing CTV services to urban areas.* This would enhance the marketing of switched wideband services to non-business subscribers.

This thin overlay network could, as demand increased, expand to any desired extent. By the year 2000, however, the conventional telephone network would still dwarf the wideband network in terms of numbers of subscribers.

Ultimately, and this would probably be well into the 21st century, all distribution would be on optical fibres, with switching in the optical mode as a strong possibility.

3.4 IMPLICATIONS FOR THE NEAR FUTURE

3.4.1 Introduction. The main short-term conclusions to be drawn from the considerations of technology and network development are discussed in this section. Discussion of mobile radio, CTV and data, is included in later Chapters.

3.4.2 Network Exploitation. Pending further laboratory and field research, the uncertainty of demand for new services, and the high costs of establishing new networks, suggest that embryonic services will be most economically introduced by making use of the present network assets.

A social argument can be added to this cost-effectiveness argument — exploitation of the existing network is likely to permit more equal access to services of the future by people in different socio-economic groups, or different geographic areas. This will aid the learning process.

More information is required about the physical and electrical characteristics of our plant, to provide a basis for its maximum exploitation. Work on this is progressing, but increased resources are required to ensure that information is available to assist decision-making in the near future.

3.4.3 Digital Networks. Perhaps the most significant trend in telecommunications related technologies is the trend to smaller, cheaper aggregations of components in digital systems. There is some debate as to whether this trend will result in significant reductions in the price of switching and transmission equipment for telecommunications authorities. Further studies are required to resolve this question.

There appears to be scope, in Australia, for a system-wide study of the economics of digital switching and transmission. Such a study would pave the way for the future introduction of digital transmission and switching systems into the unique Australian environment with optimal efficiency and effectiveness.

It should also be borne in mind that a digital telephony system could be much more adaptive to new data-based services if, as expected, these continue to grow rapidly. A 64 kb/s digital network could make use of our existing cable investment, yet provide great potential for the development of new services.

3.4.4 Developments of Distribution Media. Presently available cables are not suitable for a high demand wideband network. Optical fibre cables show great promise as a wideband distributive medium of the future but much more system-oriented development work is required. The Research Laboratories are currently preparing proposals for a research and development programme into optical fibres.

Other distributive media, such as high frequency pair cables or SHF radio may also have a role to play in the future, and developments in these are also required.

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*Depending on the availability of underground duct space, optical fibre cables might be introduced as complete replacements for existing symmetric pair cables. This strategy would conserve duct space, but would require the development of extensive electro-optic interfaces with the telephone network.

3.4.5 Ducts and Pipes. In recent years, a considerable proportion of our new subscribers' distribution areas have been laid using PVC pipe and ducts. This is not the cheapest form of reticulation but is in accord with community trends favouring underground plant. Also, it is expected to pay handsome dividends in reduced cable maintenance costs, and ease of cable replacement or addition. In short, the present provision of PVC pipes and ducts in distribution areas is a most significant investment for the future. All too often there is inadequate recognition of the very large costs entailed in opening and re-opening the ground — these costs exceed the costs of the cable itself.

The prospects of CATV and CTV service in the future, and the possible need for new, wideband, overlay cables raises the question of whether the cross-sections of pipe are likely to be adequate for long-term future needs. This question cannot be answered positively, but pipes are only provisioned for the accommodation of long-term telephone cable requirements. This would be prejudiced by the drawing-in of a coaxial cable for CATV purposes, for example.

At present only a small proportion of the total network is served with PVC pipe, but during the coming decade the penetration will increase greatly — the result of network growth and replacement of old distribution plant. A decision, now, to increase the cross-sectional area of new distribution pipes would greatly facilitate any proposed future changes in distribution cables.

Studies to date indicate that the cost of increasing pipe size would be only the incremental cost of the materials. Labour and mechanical plant requirements would be virtually unaltered. As an example, increasing street pipe from 35 mm to 50 mm increases pipe costs by about $5 per building block. This would add about 3% to the total costs of subscriber distribution work.

Even such a small percentage increase in costs represents a significant additional sum each year if all distribution work is to be affected. However, it is expected that not more than 10% of homes are likely to have 'advanced' services by the year 2000, and that cable television penetration will tend to be in selected areas. Thus, the costs of pipe augmentation could be held to a relatively low figure by selection of high risk areas.

3.5 LONGER-TERM IMPLICATIONS

3.5.1 Videotelephone Network. Videotelephones are most likely to emerge as an in-house service on privately-owned exchanges. As these private networks increase in number, there will be an emerging demand for a public interconnecting network, particularly if there is some uniformity of device standards. If the Commission is to take any role in videotelephone development it should be initially directed to the private network area, and the establishment of standards, rather than the initial establishment of a public network.

3.5.2 Distribution Media. Decisions will have to be made, in the future, about whether to introduce new media for subscriber distribution, including widespread CTV. In addition, the question of catering for long-term growth of new services will arise. How bulky would the cables become and would it be economically possible to open and re-open the ground to accommodate new growth? How can the best use be made of limited street easements; should joint use of underground ducts be encouraged? Can we aim towards a universal distribution medium, or will cable overlays become a feature of future networks?

Finally, the prospects are that whatever distribution medium is adopted in future, it will continue to be expensive and under-used. Work is required to identify economic uses of idle plant capacity and encourage such uses.

3.5.3 Switching. Apart from the digital v. analogue switching question, the advent of optical fibres raises suggestions of optical switching, to avoid electrical/optical interfaces at switching points. Much further research will be required before optical switching is available; in its absence conventional exchanges will have to be adapted to optical fibre cables. If new services proliferate, wide-scale exchange site extensions may be required in heavily built-up areas.

The question of the integration of data and voice switching will also be raised. The characteristics of the various classes of traffic are quite different from one another, but integration is theoretically possible and may become economically viable in the future. The system study proposed under the heading Digital Networks, above, could also embrace this question.

3.5.4 Labour Costs/Productivity. The Commission faces continuing high labour costs in: administration, manual network services, maintenance, and external plant construction.

Purely economic criteria suggest that there will be a continuing quest after capital intensive means of improving labour productivity. This will permit Commission staff to share in the general community productivity increases, and help to reduce relative costs of our services.

Further improvements will also be possible in presently capital intensive areas as new technology is introduced.

3.5.5 Critical Resource Shortages. Many of the key materials in our technologies are under threat of shortages and price rises during the coming 25 years, as sources of cheap supply are exhausted. Copper, aluminium and plastic materials fall into this category. It will be necessary to prepare contingency plans to meet such shortages, before they occur.

3.5.6 Network Security. This is a continuing question and some level of investment can be justified to improve network security against some risks or threats. In the future, society may become far more dependent on telecommunications than is the case at present. The Telecommunications Commission will then feel obliged to increase its investment in network security.

3.5.7 Country Areas. As new services develop, their provision to decentralised centres and rural areas may become increasingly uneconomic. This will raise strong questions of equity and cross-subsidisation, which will require resolution.

3.6 THE MANUFACTURING INDUSTRY

Australia is geographically remote from the major world telecommunications markets and manufacturers. The consequent need to ensure continuity of supplies coupled with the desire to have the capability to modify telecommunications plant designs to match the specific needs of our networks has led to the present structure of the telecommunications industry in Australia.

The local industry features large measures of both competition and overseas ownership. Of the Commission's annual equipment requirements, 85% (currently totalling about $300 million) is manufactured locally. Prices are generally comparable with domestic prices for similar equipment manufactured in Europe or America.

There appears to be no fundamental argument for major structural changes in the industry in the future. Expectations are for a steadily increasing demand for telecommunications equipment, so the overheads of each manufacturer will be spread further. However, the future directions of technology, surveyed in this chapter, indicate that there are likely to be important changes in basic telecommunications plant and equipment. Some of these changes would have equally important implications for the telecommunications manufacturing industry itself.

Firstly, the move towards optical fibre subscriber distribution, expected to begin in the late 1980s, will require a manufacturing capability which combines modified versions of traditional cable expertise in drawing, assembly, cladding, etc., along with glass/silica technology and extremely high quality control of the media characteristics. Secondly, the foreshadowed move to digital technology, initially in transmission, and eventually in switching, will greatly accelerate current moves to micro-circuitry, large scale integration of electronic components and the demise of the electromechanical era in switching. Thirdly, future moves in the terminal equipment market, particularly in data terminals, are likely to call for a vast range of devices with a core of common components, but with overlay circuitry and cladding more or less 'tailor-made' to the needs of particular industries and organisations within them. The need to supply relatively large numbers of such low-volume markets will clearly require new approaches in design and production.

The issues of particular importance stemming from both digital operation and proliferation of terminals are the source supply of basic LSI components and the economics of local manufacture in one or more production units.

It has not been possible during the present phase of studies to pursue these issues, but they have obvious implications for the future organisation of the Australian telecommunications manufacturing industry and will need to be explored. Likewise, policies will need to be developed for local research and development activities by manufacturers and by the Commission's own research laboratories, and co-operation between the two maintained in this sphere. Already preliminary consideration has been given to the research implications of our technology forecasts in framing the Commission's current research, development and innovation programme, but again this will need to be pursued in much greater depth in the years immediately ahead.

RECOMMENDATIONS

It is recommended that the Commission:

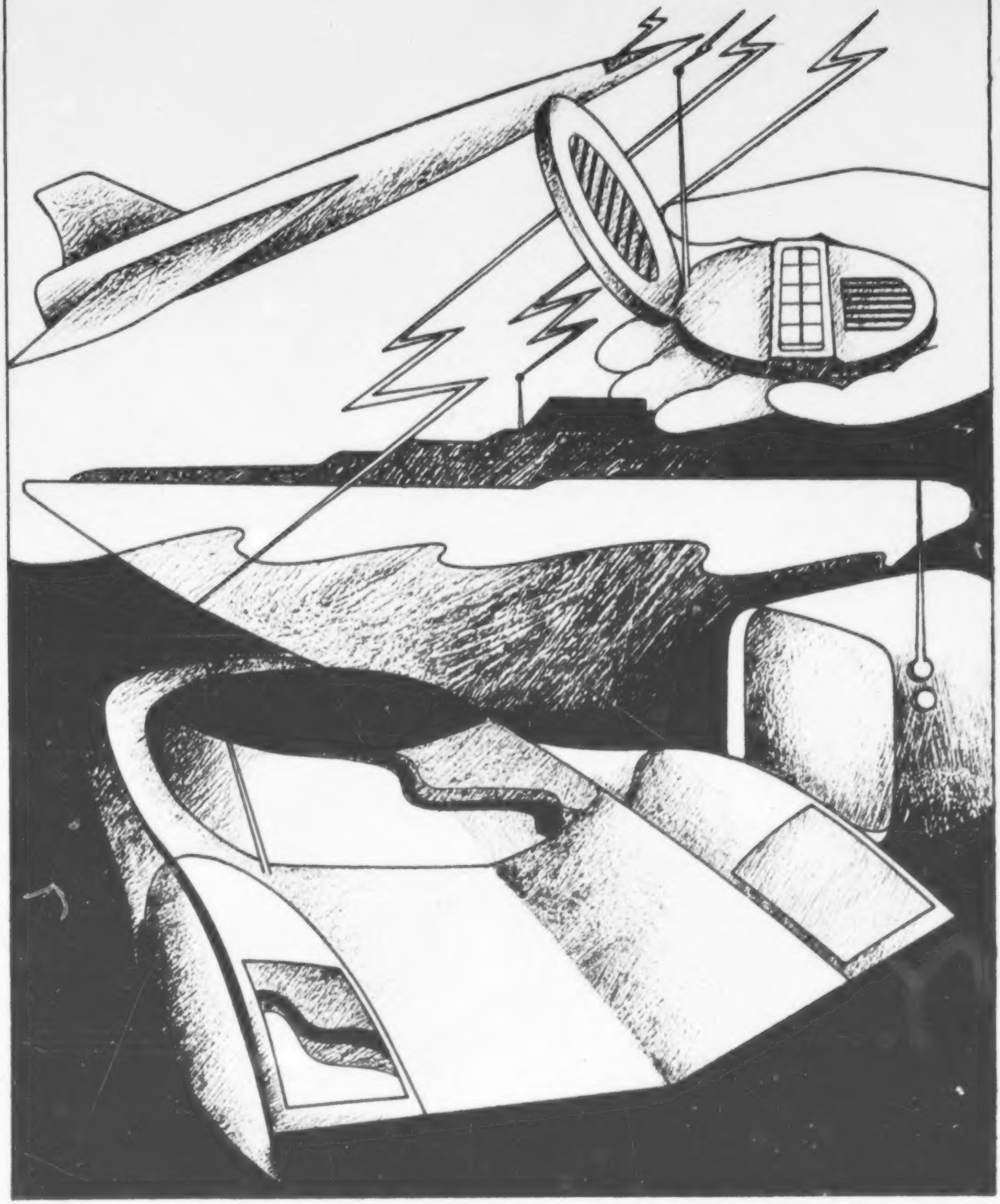
1. (i) **Reactivate, and advance, network planning studies of the applicability of integrated digital switching and transmission (IST) systems into the Australian telephone network and engage in a suitable programme of R&D to ensure that the Commission is ready to adopt the IST technology at the earliest appropriate times.**

   (ii) **Sponsor research and development in Australia of optical fibre cables and their application to practical field situations. Such a programme has recently commenced within the Research Laboratories.**

2. (i) **Give increased emphasis to network characterisation studies (the size, location and electrical characteristics of all existing plant) to assist the most effective utilisation of the plant.**

   (ii) **Consider increasing the cross-sectional area of underground pipes installed in future to minimise the 'ground-opening' costs associated with possible future distribution cables.**

4. RF SPECTRUM AND MOBILE SERVICES



4.1 INTRODUCTION

The Commission is a significant user of Radio Frequency (RF) spectrum for the provision of a variety of radio-communication links. Since the Commission's vesting, the RF spectrum management function rests with the Radio Frequency Management Division of the PMG's Department, and is completely independent of the Commission.

Mobile radio services make use of parts of the RF spectrum in the VHF (30 MHz–300 MHz) and UHF (300 MHz–3GHz) bands. At present, in Australia, the most common mobile services are privately operated (despatch type) mobiles, with taxi radio-telephones being typical. There are about 160,000 privately operated mobile units throughout Australia and the numbers are growing rapidly. The demand for spectrum is greatest in Sydney, where there is a concentration of about 25,000 mobiles.

The Commission operates a small public radio-telephone service in some of the capital cities. This is manually operated and has not been expanded for many years. As a result, the potential demand for this service far exceeds supply. Planning is underway for an automatic public mobile radio-telephone system which is expected to be introduced by the late 1970s. Demand for this service is expected to accelerate rapidly.

The Commission also operates a public radio-paging system. However, unlike mobile radio-telephones, this does not require large amounts of spectrum, even for high levels of demand.

Future non-telephony services of low transmission capacity with hard-copy printouts or visual display devices are also visualised. Their bandwidth requirements are intermediate between those of the paging service and the radio-telephone service.

Together, the development of both private and public mobile radio services will generate great demands for RF spectrum in the VHF and UHF bands. The spectrum regulatory body will have to balance the demands for these mobile services against each other, and against the likely future pressures for VHF/UHF spectrum for broadcasting. Demand forecasts indicate that very careful spectrum management, including the use of new technologies, will be needed to satisfy potential demands for VHF/UHF spectrum in Sydney and Melbourne through to the year 2000.

The RF Spectrum Management Division of the PMG's Department now controls private radio-communication networks and services (through spectrum allocation). Thus, if it were desirable in the future to amalgamate the private and (proposed) public mobile systems to gain better spectrum utilisation, the Commission might not have the necessary powers. Private point-to-point radio-communications links also fall outside the Commission's powers. Hypothetically, a private entrepreneur could establish radio-communications links in competition with the Commission if permission were granted to use the necessary spectrum. For these reasons, continuing close collaboration will need to be maintained between the RF spectrum management authority and the Commission.

4.2 MOBILE RADIO TECHNOLOGY

A combination of modern telecommunications technologies is tending to reduce the cost and size of mobile radio equipment. At the same time it is increasing the functions which can be economically included in the mobile unit.

These trends have made viable the vehicular (including boats, planes, trains, etc.) mobile radio-telephone, with access to automatic national (and hence international) telephone networks. Multi-channel operation permits efficient use of a limited number of RF channels — that is, a number of mobile units sharing a pool of channel allocations — so ensuring high average traffic per channel.

The reduction in size of mobile radio-telephone units has been such that experimental, hand-held mobiles with full network access have been demonstrated recently. A pocket unit could be achieved in a few years. Although vehicular mobile radio-telephone systems are flourishing in a number of countries, the service has not yet been extended to hand-held units. Because of power limitations, portable mobile units may have to be designed to transmit at lower radiated power than vehicular mobiles. Thus, the networks established for vehicular mobiles may not be suitable for portables and separate networks may have to be established for the latter. This would tend to retard the introduction of the portable mobile.

Mobile radio-telephones connected to a national network must have access codes to permit each mobile to be reached by other network subscribers (both mobile and fixed). Fixed services have codes related to a geographical area; however, a mobile subscriber could conceivably move at will to any part of the national network. Thus, the concept of numbering schemes must be extended to encompass a 'roaming' subscriber. There are allied problems of the system — the need to locate a wanted subscriber anywhere in the network, and to levy charges for calls to and from mobiles. In addition, the codes and charging principles adopted for mobiles should not impose severe strains on the existing fixed telephone network. In brief, the introduction of automatic mobile radio-telephones into a national network involves extensive system studies, requiring a high level of network expertise. These studies have to include a knowledge of the technical solutions which can be offered by developing radio technology.

The nation-wide network of mobile subscribers referred to in the preceding paragraph is only an objective. Mobile radio-telephone systems would evolve initially in large urban centres. At later stages the networks might extend to major transport routes and regional centres. The initial planning, however, should encompass the likely long-term prospects for network development, both in terms of the potential number of subscribers and the geographical area to be covered.

Another trend in mobile radio technology is the exploitation of higher frequencies as the VHF and lower UHF bands become fully exploited. Work overseas is now being directed towards the exploitation of frequencies approaching 1 GHz. There is a feeling in some quarters that mobile radio technology will not be able to develop beyond this general area of frequency because of propagation characteristics. That is, all future mobile radio demands would have to be fitted into the VHF and UHF spectrum between, say, 30 MHz and 1 GHz.

Mobile radio systems have used transmitters of sufficient power to cover the entire urban area of a major city. However, because of the impending exhaustion of spectrum resources at VHF and UHF, overseas developments to use the spectrum at about 1 GHz have also been directed towards more efficient use of spectrum. The approach being postulated is to reduce transmitted power, to the extent that effective operation is only possible in an area or 'cell' of, for example, 1 km radius. A mobile service area would be covered with these small cells, but frequencies could be re-used many times in each city. While this would be an economic use of RF spectrum the problem of tracing each mobile would become increasingly complex and require computerised monitoring and control. The provision of the necessary controls and multiple antennae would tend to increase the equipment costs of a cellular system, compared with costs for more conventional systems. For high demands, however, the control costs would not be dominant.

The cellular mobile radio concept is applicable to all types of mobile services to suit different types of subscriber needs. These include:

- a network-connected mobile telephone service for up to 100,000 subscribers in a metropolitan service area.
- a network-connected personal portable telephone service of over 100,000 subscribers in a metropolitan service area.
- a mobile vehicle despatch service for up to 100,000 users in a metropolitan service area.
- a mobile system capable of presenting visual or printed output.

A cellular mobile radio-telephone system would have the characteristics of being able to meet very high demands for services efficiently using RF spectrum and significantly reducing costs per subscriber as the demand increased. These characteristics raise the question of amalgamating private mobile networks into the public network. This would free large portions of VHF and UHF spectrum for broadcast or other purposes. Private networks could retain their privacy and could be designed to work at lower traffic standards than the public network.

4.3 VHF AND UHF BAND ALLOCATIONS

The spectrum of interest for VHF mobile applications starts from about 70 MHz, which is the first Australian allocation. In the spectrum from 70 MHz to 225 MHz, 28% or 44.1 MHz is allocated to mobiles in six bands. A further 50% of this part of the spectrum is used for broadcast —almost all TV. The remaining percentage of spectrum is allocated in narrow bands for a wide range of miscellaneous applications.

The spectrum slice from 225 MHz to 403 MHz is largely given to military applications.

The spectrum from 403 to 520 MHz is almost entirely a UHF mobile band (87 MHz out of 117).

The VHF and UHF mobile radio bands described thus far are used almost exclusively for privately-owned despatch type services. Depending on the number of mobile units for each service, two or three services may share a single frequency allocation, without privacy. On average, about 20-30 mobiles can be allocated to each frequency, but a heavy user, with short calls (e.g. taxis) may have up to 100 mobiles per frequency.

In Sydney, where the greatest pressure on spectrum occurs, these mobile bands are expected to be exhausted by about 1965, using current technology.

The spectrum from 520 MHz to 820 MHz is largely reserved for UHF broadcast. No plans exist for the use of this spectrum but in time the demand for additional capital city TV channels will result in new stations in this band. UHF TV channels are well established in other countries, and many new TV receivers marketed in Australia are equipped to receive UHF.

The spectrum from 820 to 890 MHz is reserved for UHF mobile, but is not yet allocated for this use. Using current non-cellular technology this band might meet demand for mobiles to approximately 1990–95. There are no mobile radio reservations above 890 MHz. The USA '900 MHz' mobile band is larger and slightly higher than the Australian band. Re-allocation of frequency around 900 MHz might be required in order to use any new USA-developed cellular mobile technology in Australia.

The proposed public mobile radio-telephone service, with automatic network access, was referred to in the introduction to this chapter. This service is expected to make some small demands on spectrum in the mobile bands by 1980. After 1980, the spectrum demands for this service are likely to increase rapidly.

4.4 MEETING INCREASING DEMAND FOR MOBILE SPECTRUM

The main options available to meet increasing demand for mobile spectrum are briefly discussed below. Demand pressures on spectrum will be met first in Sydney and Melbourne. Initial solutions will be required only in these limited geographical areas.

(i) Move all TV to UHF, freeing some 80 MHz of VHF spectrum for mobile use. There does not appear to be any strong argument favouring the use of recovered VHF spectrum in preference to re-allocated UHF spectrum, even assuming there were no community costs in making the transfer.

(ii) Re-allocate some UHF spectrum from broadcast to mobile. It is likely that mobile demand will lead TV demand for the UHF spectrum. Thus, some of the UHF TV allocation (520–820 MHz) could be re-allocated to mobile. In Australia, this seems a better option than the preceding one.

(iii) Apply a 'cellular' solution in the 820–890 MHz band. The cellular approach to frequency allocation is the one solution capable of meeting extremely high demand for mobiles co-existent with radiated broadcast TV. It is important that the UHF spectrum around 900 MHz is not used for private mobile services, if this is likely to prevent the later establishment of a high capacity public mobile radio-telephone network.

(iv) Underground all (or most) TV broadcasting in capital cities. This would free the VHF and UHF broadcast bands for mobile, more than trebling the available spectrum. Some points for consideration are:

- With no change in mobile technology to a cellular system, trebled spectrum would last 3-4 decades if growth rates continued as at present. If, however, a cellular approach is adopted, there may be no need to recover spectrum.
- There would be a community cost in loss of portable operation of TV sets. This loss would be reduced if some TV broadcast channels were retained.
- Broadcasts may have to be underground for perhaps 100 km (or more) around capital cities, to recover all or most TV channels. Underground costs may become prohibitive over such areas. However, the potential of optical fibre cables, provided in conjunction with the telephone network, must be borne in mind.

4.5 SPECTRUM MANAGEMENT

As observed earlier, spectrum management will not be under the control of the Commission. However, the way in which spectrum is managed will be of great concern to the Commission which is one of the largest single users of spectrum for a variety of communications purposes. The following discussion considers some important aspects of spectrum management for the future.

The spectrum is a 'community good', or resource, with many similarities to land. Both land and spectrum are of economic value to people who are able to use them. At any particular time, a given slice of land or spectrum can be used for only one purpose, but the resource is not destroyed by the use and can be re-used for another purpose subsequently. Also, like land, a slice of spectrum may be of greater or lesser value depending on where (in the spectrum) it is located and hence its potential uses.

There is still a tendency to treat spectrum as a 'free' good. TV broadcasters will say 'why pay for a cable when the spectrum is free?' Spectrum however, does have a cost whenever it is used; this is the opportunity cost of foregone alternative uses. While the concept is clear enough it has not been possible with studies so far to quantify the opportunity cost for the use of various parts of the spectrum; the cost will, of course, vary with time and geographic location.

Despite the problems in quantifying the opportunity cost of spectrum, there appears to be a good basis for arguing that substantial charges should be levied for the use of each Hz of spectrum. The charge could vary with the part of the spectrum being considered, but would not vary with the proposed use in any part of the spectrum. That is, for example, a mobile radio application would be levied the same charge for each Hz of VHF spectrum used as was levied against a TV broadcaster. This sort of charge would encourage the most economic allocation of the resource (spectrum), would encourage technology making more efficient use of the resource and would tend to defer the exhaustion of the resource.

As an alternative to the continuation of the present regulatory environment, the analogy with land could be pursued a little further. The community could auction freehold or leasehold rights to spectrum and these rights would subsequently be traded in an open market. The

Crown could retain powers of compulsory acquisition.

Another aspect of spectrum management worthy of further attention is the utilisation of scarce spectrum for 24 hours each day. There appears to be no over-riding reason why spectrum rights should not be limited to certain hours, the remaining time being made available for alternative uses.

RECOMMENDATIONS

Arising from the preceding discussion, it is recommended that the Commission:

1. (i) Expedite currently progressing work aimed at issuing a tender schedule for supply of public automatic mobile radio telephony equipment.

   (ii) Introduce and actively market a public automatic mobile radio-telephony service at the earliest possible date.

   (iii) Ensure that planning for the mobile service take account of the high level of potential demand throughout Australia, and in Sydney and Melbourne particularly.

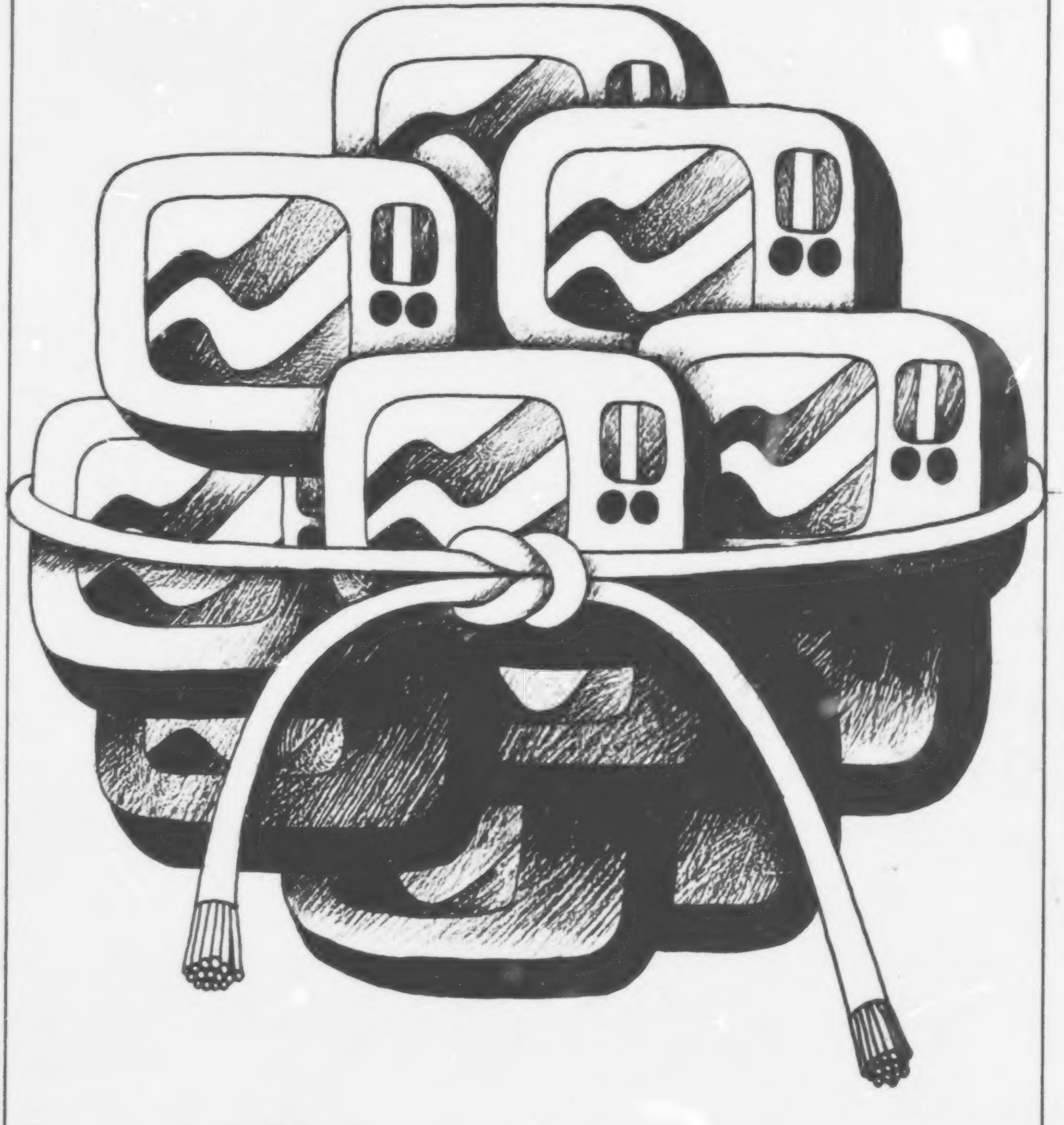
2. (i) Maintain a close and continuing liaison with the new RF spectrum management authority.

   (ii) Encourage the holding of a public enquiry into spectrum usage prior to the next World Administrative Radio Conference (1979).

3. (i) Proceed with studies of cellular mobile radio telephony systems (studies are commencing in the Research Laboratories) and monitoring of overseas developments.

   (ii) Take appropriate actions to try to ensure the reservation of blocks of RF spectrum at UHF for the later introduction of cellular mobile radio telephony systems.

5. CABLE TELEVISION



5.1 INTRODUCTION

The basic form of cable television, known as 'community antenna television' (CATV), is used in locations where direct reception of television is either impossible or only possible using expensive towers and antennae. A common or community antenna, suitably located, is used to receive 'off-air' television signals which are amplified and distributed over the cable to receivers. The point where signals are fed into the cable system, is known as the 'headend'.

As well as signals taken off-air, it is possible to inject 'live' or pre-recorded programmes into the distribution cable at the headend. The system carrying combined off-air and injected material is known by the generic name of cable television (CTV).

CTV, although basically a system for distributing television from one to many, has spare transmission capacity which is suitable for telecommunication uses such as data or voice transmission. In particular, a computer can be connected at the headend, and with suitable equipment at the terminals, users can access the computer via the cable for a range of information services. Services with a return path or 'response' capability are known as interactive CTV services. Some of these services are discussed in a later section.

5.2 CABLE TELEVISION OVERSEAS

The historical development of CTV in overseas countries, and the expectations which have arisen from this, both overseas and amongst some Australians, is a necessary perspective for viewing policy options in Australia.

The first cable television was CATV in countries such as the USA, Canada and England. Early television broadcasts covered big cities and their surrounds. People remote from these areas wanted to enjoy television too but could not receive the signals cheaply. CATV developed in response to this demand.

As the technique became known, it was applied in a growing number of situations. Not only were antennae set to receive signals on the fringe of adjacent reception areas with the transmitter being 80 km or so away, but systems were built where television programmes were relayed over microwave links 300–500 km to the CATV headend. With this approach entrepreneurs saw opportunities to profit not only in areas with no television coverage, but also by increasing the availability of programmes in those areas with limited coverage of perhaps 3 or 4 channels. People apparently wanted a greater programme choice and were willing to pay $3 or $4 a month to connect to a service which gave them this, with 'out of area' or even foreign programmes. Perhaps the extreme situation is in Belgium, where CATV systems distribute Belgian, Dutch, British, German and French programmes. In Canada and USA, where typically 10 or 11 distant and foreign programmes can be distributed by a CATV system, the overall penetration of households at the end of 1974 was 35% and 14% respectively.

The provision of CATV became a profitable investment with the growing demand for entertainment. The number of houses connected to the cable passing them, typically approached 80% in towns and cities with only 1 or 2 local broadcast stations. However, in areas where more local channels were available, the penetration achieved was lower. System operators, wanting to increase profits, sought ways to attract more connections, particularly to the lower penetration systems. They then commenced to transmit simple information such as time, weather, news and stock market reports as an additional lure to potential users, using spare channels not needed for off-air reception. Once a system had been installed with the basic purpose of distributing received entertainment programmes, the marginal cost of using additional channels was low.

At this stage several forces conjoined. More people became aware that cable systems had unused transmission capacity available at low marginal cost. Many social activists began to suggest that the capacity could be used for education, to increase the variety of programmes for minority audiences, for provision of information to people generally deprived and as a means for poorer individuals and groups to gain communication access to a larger part of the community. Some even saw in CTV the potential for greatly enhancing the democratic process by increasing participation in local decision making, particularly by making use of interactive capabilities. The ability to interconnect local CTV systems by terrestrial or satellite transmission links greatly expands the potential of all these applications.

Others saw it was possible to use some spare capacity for accessing a computer with interactive services tailored to general use, as in remote shopping or theatre booking. The entrepreneurs who financed CATV saw the additional uses proposed as a saleable commodity which would allow profitable expansion into areas which already had many broadcast television programmes, for example, New York with 11 channels operating. Expectations jumped from consideration of possible extended uses to 'there is a demand for CTV'. Techniques for additional uses were developed and CTV expanded into some regions which already had considerable television coverage. But experience over the last 3 years has shown that, where there are many television programmes available, financed by advertising or government and so 'free' as far as the viewer is concerned, people are unwilling to pay for more of the same type of programmes.

Moreover, even at low marginal transmission cost, the search for services other than entertainment, which can be profitably marketed, has not been overly successful. The main problems are software development costs and identification of particular services sufficiently attractive to bring forth demand at the tariffs which would have to be charged. On the other hand, entertainment pay-TV, which can provide viable viewing options, seems to have the greatest market potential. Pay-TV is discussed in Section 5.4.2.

Experiments to develop new uses for CTV are financed mainly by social welfare funds from Government sources. Most of this is happening in North America with some activity in Japan. Some manufacturers are undertaking limited technical experiments to develop the means for using CTV for a variety of information services, particularly those based on two-way interaction with a computer. However, these experiments cover only a few tens of terminals and the advent of the 'wired city' based on CTV is still a long way off. There are no known commercial systems providing more than simple information services such as weather, time and stock market reports.

Ownership and operation of CTV and CATV overseas is generally by private companies, and not by telecommunication administrations. In the USA, telephone administrations have been specifically excluded by the Federal Communications Commission from operating CTV or CATV in areas where they provide telephone services, though they are allowed to own the physical cable and lease it to the CTV operator. In general, they choose not to do this. In some other countries the telecommunications authority has formed joint companies with other organisations. In England, the British Post Office tenders selectively to provide CATV in competition with other companies.

5.3 AUSTRALIAN CONDITIONS

5.3.1 Background. The development of broadcast television in Australia has aimed at providing most people with access to at least one channel, normally a national station in areas of lower population. The actual number of channels available at any one place is a reflection of the population in the viewing area, i.e. the size of the market for advertised goods and an equitable allocation of public television funds. Australia is at present apparently unable to support additional programming via the existing commercial process. Various press statements about the financial difficulties of the third commercial TV channel in Melbourne and Sydney support this view; so also do the recent highly publicised cutbacks in the relatively expensive Australian-made programmes—relatively expensive when compared with the much lower cost of re-using overseas material. There is only a limited number of programmes shown in Australia because of market size and these programmes are shown in each of the major viewing areas. This, combined with Australia's remoteness from other countries, does not provide a ready source of additional programmes to feed CATV.

Currently there are eight CATV systems in Australia serving about 600 households, all in areas of poor off-air reception. In order to meet the obligations to ensure standard reception in designated viewing areas, further CATV systems will be necessary, according to Australian Broadcasting Control Board (ABCB) figures, to serve about 40,000 homes, most of which are in urban areas. These figures are for black and white. Colour reception problems may result in the number being higher because of the greater sensitivity of the eye to colour distortion, and the expectation of higher quality by users who have paid high prices for colour receivers.

Most CTV distribution overseas is above-ground using existing pole construction, often belonging to other authorities. However, in Australia the current attitude towards the environment would exert considerable pressure for fully underground distribution. The cost for this in urban areas would be from $250 to $400 (1973 prices) per building block depending on duct availability and street conditions.

5.3.2 Pressure for CTV in Australia. The pressure for CTV development in Australia seems to be coming from several directions. Some entrepreneurs have been asking for licences to install CTV in areas of inferior reception, probably those areas which would be included under a CATV policy. In addition, a number of groups who see community access as a way of increasing programme variety and mitigating social inequality, have been pressing for the establishment of CTV, particularly in disadvantaged areas. Further, government bodies responsible for decentralisation, such as the Department of Urban and Regional Development, attribute great importance to CTV as a means of providing communication facilities of high order in designated growth areas. Along with other people they see CTV as adding significantly to the quality of life.

On the other hand, some groups in the community can be expected to strongly oppose CTV in Australia. Foremost amongst these could be present broadcasting interests who may see CTV as a competing medium. They could fear that the additional channels may attract viewers and advertising revenue will be syphoned off. Another group from which opposition may be expected consists of those who fear the alleged centralising and de-humanising influences of widespread cable television and a consequent increase in dissociation throughout society. Some recent social research supports this view and, although inconclusive, casts doubts on the efficacy of the TV medium for cognitive learning processes.

5.4 POTENTIAL MARKETS FOR CTV

5.4.1 Background. Many services have been postulated for CTV beyond entertainment television. There appears to be an assumption that cable television can provide people with more information and that they are willing to use this medium of telecommunications to obtain it from one-way broadcasts or two-way interactive operations. This assumption is generally made by those who are already used to handling information. Whilst it may be valid for them, there is evidence to suggest that considerable numbers of people, especially those who are often classified as 'information deprived', may not find this medium particularly helpful.

It is further assumed that CTV is the most cost-effective way of providing information. However, this rests on the low marginal cost of spare information capacity, once the prime cost has been paid for by a significant use such as entertainment television. Without this assumption, CTV is probably not competitive with basically similar services which are within the capability of the symmetric pair telephone network for the levels of demand for information services currently foreseen. For instance, advanced visual information services using computer backup could be provided over the telephone network and displayed on the home TV receiver. In the absence of cable television, research and development for the provision of visual information services which exploit the existing telephone network could be justified. (See also Chapter 9, Introduction of New Services).

The following services show promise under suitable conditions, particularly where CATV already exists.

5.4.2 Pay-TV. Pay-TV is a service provided on some established CTV systems overseas. In addition to the charge for connection to the cable, subscribers pay to view special programmes such as 'first-run' movies or special sporting events which would otherwise not be broadcast by the regular off-air service. Payment is either per programme viewed (using for example a coded magnetic card to 'unlock' the special programme channel) or monthly for permanent connection to the pay channel. One result of pay-TV may well be to increase competition for high quality or high interest material.

Pay-TV has generally relied on use of marginally costed broadcast capacity. However, it would not be unreasonable for an entrepreneur to establish a cable system in some wealthy areas purely to distribute pay-TV. Even with estimated costs for Australia of about $250 to $400 per reticulated building block, a profitable marketing situation could be postulated, but which of course would need to be verified in practice.

5.4.3 Educational Uses. Some people believe that the bandwidth of a cable television system has considerable potential in education. The uses could range from broadcast lectures to individuals 'interacting' with a computer for gaming and computer-assisted learning. As well as the cost of establishing a cable system, large costs could be involved in establishing programme material and in replacing existing school methods with methods tuned to telecommunications. For instance, an advanced interactive system developed by the Mitre Corporation in USA currently requires programme content and software costs of up to US$1m per tertiary course of one semester in mathematics or science. In spite of the costs, the problems facing education suggest that co-operative research by the Commission and educators could be fruitful and should be fostered.

5.4.4 Services using Two-Way CTV Capability. CTV is basically a means for distributing television from one to many. It is not two-way switched video; however, CTV can be designed so that part of the transmission capability can be used in the return or upstream direction from terminal to headend. The return bandwidth can be used in various ways.

Some examples are:

- low speed digital response-channels
- 4 kHz audio channels
- a limited number of full 5 MHz video channels
- very high-speed digital data streams

Return video channels can be used to bring programmes from community centres, homes or other locales adjacent to the cable, to the headend (or other injection points) for subsequent retransmission over the system. It is possible to design systems which can prevent unauthorised access to selected channels including return ones. This can extend the use of return video for special markets such as medicine and law enforcement.

Return audio channels have similar uses. They can be used in conjunction with a broadcast, downstream, video programme to provide response capability in a lecture or conference situation. The operative response channel at any time would be chosen by the lecturer or a chairman.

Data streams can provide the facility for people to reply to questions or participate in referenda presented on any of the downstream channels using animated video, fixed frame video, audio or data. The technical requirements are suitable terminals and a computer controlling the data service. This is also the basis of computer interactive services which people can use to access data banks for remote shopping, theatre bookings, classified advertisements and many other purposes.

5.5 CONTROL OF CTV

The uses of CTV potentially are many and may significantly influence social processes. Therefore in any country the control of CTV is a key political issue which must be considered prior to any decision to introduce CTV.

5.5.1 Ownership and Operation of CTV. The ownership and operation is a complex question in which several interrelated functions can be identified; namely, provision and ownership of the physical plant, operation and administration of the system and supply and control of programme material.

Provision and ownership would include planning and design of the system, specification for the division of the cable capacity into communication channels (for example, the number of television channels or the capacity of data streams) and the modulating and multiplexing techniques. The owner would determine whether the system distribution would be underground in ducts or 'buried in the solid,' or if it would be 'aerial'. These decisions could not be determined in isolation and would result from agreement with system operators and potential users.

Operation is a multi-faceted activity. First there is the technical operation of the plant such as the day-to-day maintenance of cable and the associated electronics, repair of faults and the connection and disconnection of subscribers' terminals. Next is marketing the service—the householder or business is sold or leased appropriate terminals and is charged some fee for connection to the system. Lastly, operation includes arranging for supply of programme material for the system. The operator can permit programme suppliers free access to transmission, or can charge a fee based on the value programme suppliers attach to the ability to communicate with customers connected to the cable.

These considerations of ownership and operation apply to each separate CTV system serving specific geographical areas even if facilities should exist for interconnection. Whilst it is feasible for the same organisation to both own and operate CTV, the separation of ownership and operation should be examined and the advantages and disadvantages considered.

Ownership. There are various options for provisioning and ownership. It could be the responsibility of a single government authority, it could be local government function, private entrepreneurs could be licensed to provide CTV systems or there could be a range of joint ownerships. There are, however, strong grounds for the Commission to own and provide the physical CTV plant in Australia, since it has the responsibility for Australian telecommunications. The potential integration of services such as telephony and data on the same physical plant as used for CTV, using the same set of ducts, could lead to significant economies in national resources. This is true for coaxial cable systems; moreover, in the future, optical fibres, carrying all signals for television, telephony and data, in the one cable sheath, could revolutionise national telecommunications.

On the other hand, if the Commission is not able to marshal the resources or for some other reason of policy is not prepared to provide CTV, it would be difficult, even if desired, to resist the forces of entrepreneurs, citizens' groups or municipalities which might wish to provide CTV. Policies of capital contribution with ownership going to the Commission (as in the Spur Line Policy) could be appropriate*.

So long as public telecommunications and CTV systems used separate cables (sharing a common set of ducts) plant maintenance could be perhaps the responsibility of the CTV operator who would be interested in maintaining good performance. However, if services were integrated in a single system, the Commission as provider of public telecommunications and owner of CTV would logically be the party responsible for maintenance, though demarcation lines would need to be carefully drawn.

System Operation. As noted previously, operating a CTV system includes marketing connections and channel capacity, and obtaining a balance of programmes and services which will attract subscribers at a profit. Operation could be in the hands of a single body—e.g. commercial organisation, public institution or community group—or separate bodies could lease separate bandwidth on a system. The same bodies could lease communication capacity on several systems and set up interconnection.

Alternatively, the sale and provision of connections to the cable could be in the hands of the major or first lessee of bandwidth who would be permitted to charge a fee for additional use of the connection. There could be many possible ways of sub-dividing the cable bandwidth for many uses. Practical schemes would need to be based on community requirements.

Whilst there are arguments for the Commission owning CTV, separation of commercial operations is highly desirable. This allows competition to develop in supplying programmes and services, leading to innovation which might be otherwise stifled. It also affords some protection against fears of excessive power residing in a single organisation. Such fears have been repeatedly expressed in NTP's interaction with media and community groups.

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* The Spur Line Policy requires capital contributions to be made by the beneficiary for the construction of trunk telephone lines from the public network to remote locations not normally served. Typically, the policy applies to mining company towns such as Gove in the Northern Territory.

Although common ownership and operation of CTV would confer flexibility in planning, consistency of standards and the capability to readily upgrade systems, the view on balance is to recommend the separation of these two functions.

However, it would be reasonable for either the system operator or the Commission to provide on CTV advanced visual information services using computer backup.

It has been argued consistently in other chapters of this report, that some of the most significant, long-term, social implications of any system relate to its organisation. Therefore, field trials, in-house research and system monitoring should include a focus on alternative organisational forms appropriate to CTV.

5.5.2 Pricing and Capacity Allocation. The initial capacity of CTV systems in Australia would be expected to be well in excess of the availability of potential programmers. Pricing of channel leases in these circumstances would be a complex function of system costs, connection charges for access, and demand to provide and receive information. The abundance of channel capacity should ensure that many users can be accommodated—users who could not afford to broadcast information under the economics of the present broadcasting system. However, the abundance of capacity may cause problems for an operator trying to sell broadcasting time to a range of people, some of whom place great value on the broadcast and some of whom will only communicate if the costs are low.

5.5.3 Programme Regulation. The present regulations for broadcast television are based in part on the limited broadcast capacity of the radio frequency spectrum. A second factor is the small Australian market for goods and services which in turn generates severely limited advertising revenue to finance commercial television. It is assumed by present regulators that these funds must not be spread too thinly in supporting programming, else the quality of Australian broadcast television will be much lower than is acceptable; hence the number of broadcast licences are limited. Other sources of funds, excepting government financing of the ABC, have not been seriously considered in this country, although stations funded by subscription or from education sources are possible.

The limitations on broadcasting capacity would almost disappear if CTV extended throughout the community. With this restriction removed, once a reasonable penetration had been reached almost anybody should be able to broadcast messages to some geographically defined community using CTV.

However, there is still the question of market limitations. Existing broadcasters could claim that CTV provided unfair competition and by attracting viewers from their regular broadcasts, would syphon off advertising revenue. The broadcasters would then be forced to lower the quality of the programmes that they could provide.

Some of the new services proposed for CTV would certainly compete for viewers' time but not necessarily for funds. Rather, they would attract funds from other sources such as education, local business advertising, community welfare and in the case of pay-TV, from the viewers and perhaps indirectly from cinema operators. If a need was felt to protect present broadcasters from competition in the 'market place' even beyond a transition period, it would still be possible to regulate for no more than the existing number of programme suppliers funded from advertising. The broadcasters themselves could claim copyright to their programmes and refuse permission for redistribution over CTV. Copyright, not only with respect to redistribution, is another question which will require considerable study.

Censorship and maintenance of community standards could be the responsibility of the programme provider in general, to be dealt with under the existing community laws. An exception could be broadcasters who were protected by regulation from competition and who could perhaps be subject to supervision as at present.

5.5.4 Security, Privacy and Access. There are fears that, because of the bothway transmission capability, CTV could endanger privacy to an extent that it is seen to have the potential of a powerful surveillance and control system such as described in some modern literature. Legislation is needed to protect data which is transmitted over the system and stored in associated data banks. Practices which result in surveillance of individual use of the system should be outlawed.

People should be given the right to access CTV services provided on cables passing their premises, if they so desire, for the same price as their neighbour, i.e. charges should not be discriminatory. Some very poor people may need subsidy.

In the same way, everyone should have the right to access CTV, to send messages to the community. To foster this right, a public access channel should be reserved in any system provided by the Commission. This is consistent with practice in the USA where current rules of the Federal Communications Commission make it mandatory for CTV operators to provide a separate channel free of charge for each of: public access, education and local government. The use made of these channels in the USA (and similar facilities in other countries) has so far not met the high hopes of a few years ago. The relatively poor record of public access is mainly due to the fact that it cannot match the expectations of distributed network television viewers. Similar remarks apply to televising local government activities. Nevertheless there are strong social grounds for providing a public access channel.

5.5.5 Framing the Regulations. Many of the questions of administration and control are social and political and outside the responsibility of the Commission. They need to be considered by a suitable government-sponsored committee, with representation from such bodies as the ABCB, Department of the Media, the Department of Urban and Regional Development, the Australia Council, the Priorities Review Staff, commercial broadcasters and community interests. The Commission would need to be strongly represented because of its responsibilities for Australian telecommunications.

In the meantime, to gain experience of the potential of augmented CATV, it is necessary to allow uses of existing systems for other than off-air programme distribution. To this end the present prohibition on the injection of other material should be revoked. Some order needs to be kept and so any contractual arrangements for augmented services should be subject to the agreement of the ABCB pending the outcome of the recommended committee's activities.

5.6 FIELD RESEARCH

Many facets of CTV potential are unknown or at best are mere speculation. Many community services which are described in world literature depend heavily on connection of computers and provision of software to meet people's needs and on the development of suitable terminals. Considering all the factors foregoing in this Chapter, the value of CTV in Australia is quite uncertain. Before embarking on a full scale implementation programme it would be appropriate to conduct field research in Australia. The reader should refer to Chapter 11 of the report for a detailed discussion of field research.

5.7 FUNDING

An estimated capital investment around $3100m would be needed to provide CTV based on coaxial cable, in all urban areas and major provincial towns, in the period to the year 2000. This sum represents an increase of about 14% in the expected telecommunication investment without CTV. Integration of other services with television distribution could reduce the total funds needed. The more likely development to serve from about 4% to 16% of the homes by 2000 would need capital in the range of $120m to $500m. The cost of providing CATV to the estimated 40,000 homes in poor reception areas is about $12m.

A number of possibilities exist to obtain capital contributions. Authorities responsible for urban and regional development, education, and for social welfare may consider CTV a necessary communication medium for new and revitalised regions. Entrepreneurs may be required to make an initial capital contribution as a condition of the operating franchise. Land developers might be required to provide the capital for CTV on their estates as many are now obliged to provide other services.

Later expansion of CTV could be partly funded from operating profits.

5.8 TECHNICAL

With present technology the distribution medium for CTV is either wideband VHF/UHF coaxial cable with frequency division multiplex multichannel operation or high frequency (HF) multipair cable with baseband distribution from 100 kHz to 7 MHz.

Coaxial cable is mainly used. Modern systems can provide up to about 36 channels on the one cable but 20 channels seems a reasonable practical compromise between desire to exploit all the bandwidth possible and stringent technical operating conditions. The coaxial cable type network has a tree like form with a main trunk leaving the headend and branches off this distributing the signal to the terminals. Television receivers with variable tuning are needed to access the various channels available (see Fig. 1).

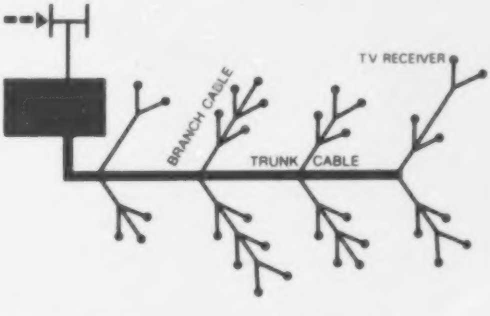


Fig. 1. Cable television—coaxial cable network

HF pair networks are hub type, like the telephone networks with a separate distribution pair to each terminal from a network node. A node serves about 1000 terminals and is connected to the headend by a trunk cable. Fixed tuned receivers are used.

Switching between channels occurs at the terminal for coaxial cable multichannel systems. The pair system carries one channel from node to receiver and switching occurs at the node; control information is carried over a second pair from terminal to node (see Fig. 2).

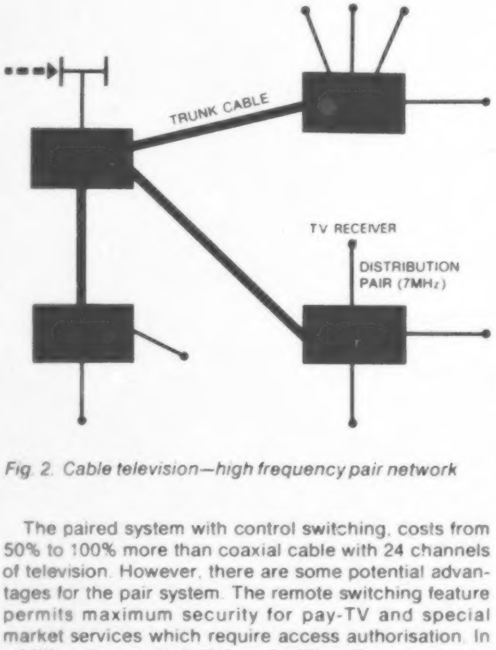


Fig. 2. Cable television—high frequency pair network

The paired system with control switching, costs from 50% to 100% more than coaxial cable with 24 channels of television. However, there are some potential advantages for the pair system. The remote switching feature permits maximum security for pay-TV and special market services which require access authorisation. In addition the central dial-up facility offers access to unlimited numbers of video channels without additional distribution cabling. Two-way services could be simpler to introduce. Once a coaxial cable system has been installed it is very expensive to change frequency allocation and to provide new services. Pair systems have greater flexibility in this respect. The system design for paired systems could probably be used for an optical fibre based network, where each subscriber has individual fibres to his premises. However, careful detailed studies would be needed to determine in which situations the additional cost of a paired system is justified.

Some research in the British Post Office is aimed at using coaxial cable for both television distribution and telephony and data services. Television would use the spectrum above 100 MHz and the other services below this frequency. This development has some probability of success but may be overtaken by optical fibre developments.

Similarly being discussed overseas is the concept of twin micro-coaxial cables for CTV with the inner conductors being used as a pair for telephony and data using time division multiplexing techniques.

The allocation of bandwidth to television channels in CTV is intimately related to the terminal sets. Standard VHF television receivers for off-air reception can be used for only about six channels and certainly no more than eight, even though there are 13 positions on the receiver tuners. The receiver selectivity is insufficient to discriminate between adjacent channels. Operation on coaxial cable CTV with more than say six video channels would require separate converters associated with standard receivers or alternatively, receivers with tuners having a larger number of channels. Multi-pair HF cable CTV can operate with fixed tuned and somewhat simpler receivers which in volume production may be less expensive than the standard receiver.

Initially the cheapest system, considering the total community costs, would use existing receivers, with subscribers purchasing or leasing auxiliary tuners if they wished to use any additional channels. Additional channels would of course need to be outside the reception band of the standard receivers to prevent adjacent channel interference.

Compatible Australian standards for terminals of all types, not just television receivers, and transmission systems would be needed for CTV on a national scale for efficiency in resource usage and to cope with a mobile population. The chosen standards would need to be set in a framework which permitted evolution as experience and inventiveness lead to new uses. Consultations between government, telecommunication and electronics manufacturing industry, television industry and the community would be necessary, prior to formulation of standards. This is of particular importance because CTV could provide Australian industry with a significant new market to supply.

Preliminary consideration suggests that CTV should be coaxial cable based, because of the cheapness, even though HF pair distribution would have some technical advantages. The initial standards should be set to utilise existing terminals as far as possible.

5.9 PORTABLE VIDEO SYSTEMS AND CTV

It seems inevitable that people will increasingly gain access to portable video systems—camera, disc, tape and monitor. The significance of this is that portable video systems may well play a role in video communications analogous to that of the pen in developing the print medium.

It has been suggested that successful use of portable video in the community will be complemented by the existence of CTV as a distribution medium. Groups with similar interests would exchange videotaped material or inject such material into local access channels. However, experience in the UK and Canada suggests that portable video development does not depend on the existence of a complementary CTV system. Hence, an increasing market in portable video does not necessarily imply an increasing market in CTV.

In fact, it could be argued that, in the immediate future, portable video could be a competitor of CTV for the so-called educational market; portable video has advantages over CTV in terms of higher degree of context, active involvement in learning, timing flexibility and range of choice, and these advantages are crucial in the educational market. In addition, video libraries, etc., (e.g. cartridge, cassette, tape and disc) could develop as strong competitors for the video entertainment market.

5.10 CONCLUSIONS

The initial drive for CTV in Australia will stem from the need to improve signal reception in those urban areas which currently suffer from poor picture quality. There is doubt about the present ability of the Australian consumer market to support a larger supply of widely distributed entertainment programmes. So far resources for other services proposed for cable television are not readily obtained. The exception may be pay-TV which could trigger a more rapid development of CTV by diverting resources from other entertainment areas.

Once a profitable use has been found to pay the prime cost, then other services, relying on low marginal cost of transmission, may evolve.

The provision of CTV, for whatever reason, raises important social and political issues which must be investigated and policies developed.

CTV provides an abundance of television broadcast channels; programming regulations, which are appropriate for today's conditions, will be inappropriate for a community serviced by CTV.

The potential of CTV to affect Australian social processes in many ways calls for a thorough understanding of both good and bad effects. This requires field research in suitable communities. The importance of such research cannot be emphasised too much if CTV appears likely to grow to any great extent.

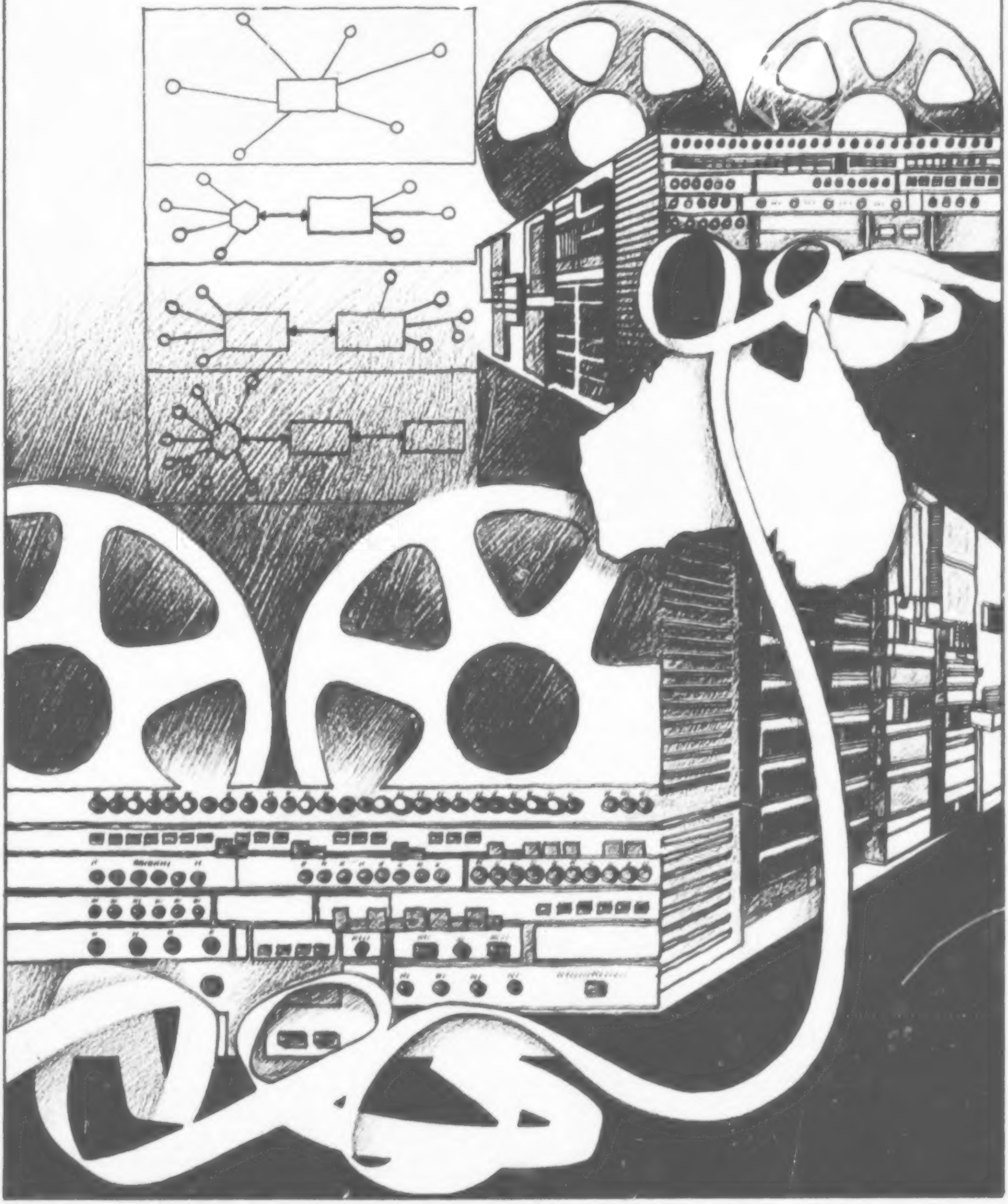
RECOMMENDATIONS

It is recommended that:

1. One channel be reserved for public access in cable TV systems provided by the Commission.
2. The Commission take the initiative with educational authorities in jointly planning and undertaking research into and pilot studies of interactive educational television.
3. In the absence of cable television, research and development proceed on the provision of visual information services which exploit the existing telephone network.
4. The Commission should own the physical transmission plant. This stems from substantial economies of common provision which will increase in the long-term if a common-cable medium (optical fibre) becomes available to reticulate both public telecommunications and CTV services.
5. The principle of separation of ownership and operation be supported in any draft legislation for cable television; this should not exclude provision by the Commission of visual information services.
6. The Commission lease CTV capacity to CTV operators who might be commercial entrepreneurs, institutions, or community groups; guidelines for franchising and channel assignment should be developed by the government committee proposed in recommendation 9. Any interim contractual arrangements be subject to later revision if they conflict with subsequent legislation arising from the work of the proposed committee.
7. The present prohibition on the injection of other than off-air program material be revoked, but that any contractual arrangements for augmented services be subject to agreement of Australian Broadcasting Control Board pending outcome of the recommended committee's activities. New CTV systems installed should have a capacity of at least 20 channels with capability for injection of programme material at one point at least in addition to the 'headend', and for a response capability equivalent to at least one TV channel bandwidth.
8. Concrete proposals for field research of CTV be developed by the Commission.
9. A Government sponsored committee be established to investigate outstanding aspects of CTV. Committee representation would need to include the Commission, Australian Broadcasting Control Board, Department of the Media, media and educational groups, as well as independent members. Public views should be sought in open hearings.

In addition to the specific matters referred to under the headings of Pay-TV and Franchising and Channel Assignment, the recommended committee would need to consider questions of privacy and access, and other social ramifications, responsibility for programme content, franchising of operations, and general matters of programme control.

6. COMPUTERS AND COMMUNICATIONS



6.1 INTRODUCTION

The past five years in Australia have seen a rapid convergence of computer and telecommunications systems. Many private computer systems, originally performing data processing functions, have added remote computing facilities, while telecommunications systems are making increasing use of computers for control of switching equipment. Major trends in computing technology are expected which could result in an increased availability of dispersed processing power serving wider sections of the community in entirely new fields. If this happens, a dramatic increase in the number of computer based data services can be expected. It is for this reason that most of the discussion in this paper will be concerned especially with computers and data communications.

6.2 RELATIONS BETWEEN COMPUTER AND TELECOMMUNICATIONS SECTORS

There are various ways in which the increased importance of the computer and telecommunications sectors in the economy can be assessed. A useful overall indication used in other countries is their share of GDP. However, because of the absence of appropriate statistics in Australia, other specific ways of describing growth have to be used. Those considered in this paper are capital investment and systems installed.

Continuation of current growth trends in these areas is likely and will take up an increasing share of national resources in the future. This means it is of vital importance that planning of national resources takes into account the structural differences between the two sectors.

6.2.1 Rate of investment, provision and innovation. Telecommunications networks involve large, long-term investments. New services and new networks, therefore, cannot be introduced widely in a short time. However, the computer sector is in a position to meet user demands on it much more quickly than the Commission can meet its new demands. The computer sector's investments are not as large, and this sector is at present more flexible financially than the Commission, if not within Australia, then certainly on a multi-national basis. However, if the computer industry continues to grow at its present rate, the large sums which it will need to invest will not permit such rapid changes as are seen today.

6.2.2 The different economic lifetimes of computer and telecommunications equipment, typically, 5–10 years and 10–40 years respectively at present. A view has been expressed by OECD that with the merging of the two technologies in the future, economic lifetimes will become less disparate and different resource allocations by both the Commission and the computer sector will be required. Accepting this, a re-examination of the Commission's depreciation policies for computer links and data equipment, and consequential tariff implications, might be necessary. There may also be a need for the computer industry to re-examine the effective lifetimes of computer equipment. Overall, the need will be jointly to balance rate of investment against economic lifetime in an effort to conserve total national resources. A joint investigatory study may be the best means of determining methods to achieve the necessary balance.

6.2.3 Characteristics of ownership. The computer industry in Australia is competitively structured, while the telecommunications sector is essentially monopolistic. Support for the view that government monopoly control of common carrier networks be maintained is expressed in Chapter 13. This view can be supported further by the fact that computer/telecommunications will play a central role in the future widespread distribution of information. Any substantial relaxation of the common carrier monopoly could lead to a situation where the nation is dependent on private business organisations whose goals may not always coincide with national interests.

Any discussion of the common carrier monopoly must also consider whether the Commission should provide telecommunications only, or computer power and services as well. As expressed in Chapter 13, there are strong social arguments favouring the general separation of the telecommunications and data processing sectors, reinforced by legislation. The Commission should support any action needed to develop appropriate policies in this area at the Government level.

Another significantly different characteristic of the two sectors is that concerning their planning horizons. Most private networks are provided by the computer industry to satisfy a user's specific and relatively short-term business need. Telecommunications planners, however, often work to planning periods of up to 20 years. This disparity makes a joint approach to balanced planning difficult to achieve.

6.2.4 Separate Technical Standards. Computer standards are set principally by manufacturers, and usually the most powerful ones, operating mainly through ISO. Telecommunications standards, however, are effectively established by national telecommunications administrations operating mainly through CCITT. Since the largest computer manufacturers are multi-national, their influence on standards is felt most at the international level. It has been noted that the strength of some computer manufacturers enables them to set their own standards independently of both ISO and other manufacturers.

The disparity in the process of standards development between the computer and telecommunications sectors has been recognised by both OECD and the Australian computer sector. There is world-wide agreement that the setting of joint standards must precede the establishment of future effective national or international networks. In fact, it is considered likely that any of the Commission's future plans for inter-connection of private network computer systems could be inhibited unless proliferation of standards in the two sectors is arrested quickly. It is imperative that the Commission take a prime co-ordinating role in standards development, while ensuring user needs are not inhibited, nor innovation stifled, rather than waiting for such standards to be fully agreed internationally. This may only be achieved by the formation of a sufficiently powerful organisation comprising representatives primarily from the Commission, telecommunication and computer manufacturers, the public service sector, other users, and the general public. Such standards should extend beyond technical issues and take into account privacy, access, security, and reliability as discussed in more detail in Section 6.6.2.

6.3 COMPUTER TRENDS—PRESENT AND FUTURE

6.3.1 General. Developments in all of the component areas of computer systems have occurred continually over the past 25 years, and even more dramatic developments can be expected in some areas in the future. For the purpose of this paper, discussion will be centred around developments expected in the areas of computer growth, costs, hardware, software, peripherals and terminals, and finally computer systems.

6.3.2 Growth Trends. It has been estimated that the number of computers in use around the world is presently about 200,000, and is growing at about 25% per annum. If the current trend continues, as expected, this figure could reach 2 million by 1985. In Australia, there are presently some 1600 computers installed, and the current growth rate here is also about 25%. If this trend continues, Australia could have some 16,000 computers in use within the next 10 years.

However, more significant trends for the Commission as indicated in Figure 1 are the current annual growth rates in:

- computers with telecommunication facilities (new or add-on) 60%
- telecommunication lines for computing 60%
- organisations installing computers 46%

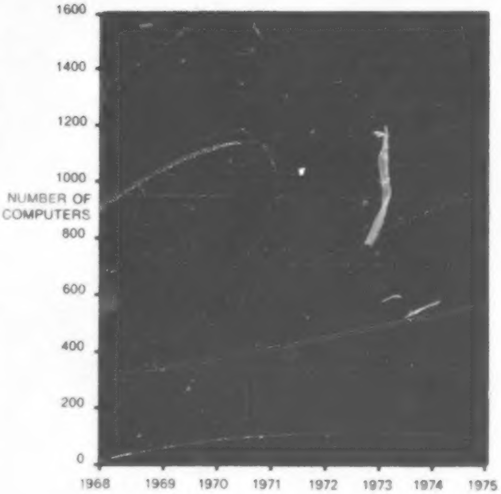


Fig. 1. Growth of digital computers (Australia) (Ref. Data Trend, EDP Manual)

6.3.3 Cost Trends. The dominant investment in current telecommunication-oriented computer systems is in processing and storage, which contribute nearly half of the present cost of a typical system. The present cost breakdown is shown in Figure 2.

There is general agreement that the cost of computer hardware will continue to fall rapidly due to cost reductions in logic and memory, as indicated in Section 6.3.4. However, the cost of complete (hardware and software) systems will not fall as rapidly as the cost of the system components, due to the relatively slower decrease expected in the cost of system software. Systems analysis and programming for new applications will also contribute to making software cost the largest component of the total system cost. The cost of a complete system is expected to fall by only a factor of 2–3 over the next 10–15 years.

The expected cost breakdown of a typical system in 10–15 years time is shown also in Figure 2, in which the expected change in emphasis from hardware dominance to software dominance has been shown.

6.3.4 Hardware Trends. Current computer logic technology is dominantly semi-conductor, in which LSI techniques have contributed towards dramatic improvements in speed, cost, reliability, and size of logic

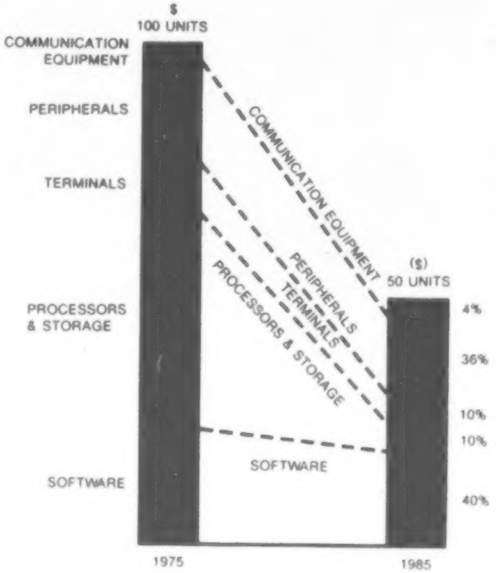


Fig. 2. Trend in computer system costs (1975-1985)

elements. It is the accelerating rate of change of semi-conductor technology that makes speculation about likely computer development beyond about 1985 extremely difficult.

Developments that have occurred over the past two decades in logic speed and cost are shown in Figure 3, and to some extent extrapolation is possible. Current opinion is that over the next decade, the logic cost/performance ratio could improve by at least two, and possibly three orders of magnitude. Similar improvements can be expected in memory speed, cost and storage density as semi-conductor memories become dominant. New memory technologies such as magnetic bubbles, charge-coupled devices and laser-holographic devices are presently undergoing a great deal of research, and will gradually appear in new types of storage systems over the next decade.

A direct result of improvements in logic technology has been the development of the micro-processor. When mated with high-density semi-conductor main memories, these micro-processors become fully-fledged micro-computers in their own right. The current mini-computer will evolve through the development of a slightly more powerful micro-processor to retain its position in the family hierarchy. Larger, more powerful micro-processors will then evolve to be combined to form large, multi-processor computers.

6.3.5 Software Trends. As previously intimated, the cost of software will become the dominant cost in the system, mainly because of complexity and the cost of programming. Consequently, reductions in software costs will be sought through continuation of the trend towards micro-programming; that is, incorporating more and more compiler functions, sub-routines and even parts of programs into hardware. Already, this trend towards micro-programming is helping to increase computer speed, reduce overhead software, reduce the amount of memory, and make computers easier to program.

Another significant software trend expected is the development of application-oriented rather than machine-oriented languages, for the desirable purposes of reducing machine dependence and assisting users to program specific applications more easily. Programming languages themselves are expected to become simpler in the longer-term and oriented towards an end-user with little programming experience. There is evidence that simpler languages such as BASIC are becoming more popular and it is expected that users will eventually be able to communicate directly with the computer in a restricted form of English.

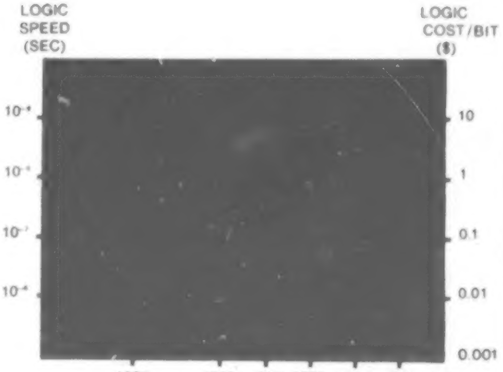


Fig. 3. Logic speed and cost improvement

6.3.6 Peripheral and Terminal Trends. During the past 10 years, there has been little change in the cost/performance of conventional electromechanical peripherals such as card readers, card punches and line printers, and any further significant cost improvement is unlikely. The greatest potential for improvement lies with those peripherals which rely heavily on logic components, particularly in the areas of LSI and electro-optic technologies. Optical character recognition (OCR) and computer output microfilm devices are considered the most likely alternatives to conventional electromechanical devices.

It is in the area of remote terminals, where logic now makes a significant contribution to cost, that the greatest potential exists for improvements in cost/performance through the advent of LSI. The visual display unit (VDU) is expected to be the dominant terminal device in the future, and a reduction in the cost of a typical unit by a factor of three could be expected by 1980. At that stage, logic and memory will contribute only about 5% of the total cost and any further reductions will be possible only through the development of new display technologies, currently in the research stage. Further significant cost reductions will then depend on the advent of mass markets.

There is, however, a considerable body of opinion suggesting that savings from the reduction of component costs will go towards incorporating more processing power in the terminal rather than resulting in a cheaper terminal for the same performance. This trend could lead to a rapid development of 'intelligent' terminals; that is, programmable terminals able to perform some system applications which would otherwise be performed by a program in the central computer.

Another significant development is the current trend by the major computer suppliers to provide industry-specific systems, rather than particular items of hardware. Here a total system is being provided, combining central operating system and application software packages, together with programmable terminal systems. This trend will probably result in terminals being developed to provide those functions required of particular industry applications. Such a move will naturally support a trend towards specific, special purpose terminals rather than a 'universal' terminal. In this case, the cost of terminals will depend largely on the sizes of the various market segments. Initially, large specialised markets such as banking or point-of-sale terminals will result in the earliest cost reductions. However, increased use of design and production automation in the next 10–15 years will lower the number of units necessary to realise significantly lower unit costs in smaller market areas.

Other terminal developments are likely in the medium to longer term which could dramatically increase the range of possible user applications. These include:

- advanced word processing terminals—an electric typewriter terminal provided with magnetic card storage, which can function as a more powerful typewriter with simple editing capability; as a means of message interchange to a remote terminal; or as a computer terminal
- home TV receivers with interface devices to provide an information display capability. An example is the British CEEFAX system. Such systems can be expanded by providing an interactive capability
- voice-input and voice-output devices, which exist today in limited applications
- facsimile terminals which, through the application of available technology and mass markets, could allow economical A4 page transmission in about 30 seconds on the existing switched network within 5 years, with the potential for improvements of an order of magnitude in the long-term using digital techniques on new networks. Off-peak transmission could allow lower operating costs, possibly leading to a competitive telemail service in the long-term
- low-speed OCR input devices which avoid the need for data transcription

6.3.7 System Trends. The component trends suggested in the preceding sections, when taken collectively, are expected to lead to a feasible evolution in computer systems which is agreed by several writers. Trends foreseen are outlined below:

- rapidly decreasing costs of hardware, developments in large memory speed and size, and trends towards modular micro-processor architecture and parallel processing are expected to make the future use of large centralised computer systems viable for certain applications such as large time-sharing and information-base systems.
- continued rapid development of mini-computers and 'intelligent' terminals will result in a proliferation of distributed processors, able to stand-alone in many applications and perform many of the system functions now handled economically only in a large central computer.
- there will be a trend towards modular design as a means of increasing reliability and flexibility, and reducing complexity, regardless of whether large central computers or distributed mini-computers dominate. System updating will be simpler through the use of new compatible modules (a faster arithmetic section, a larger or faster memory, etc.) as new developments occur. Users will be able to program their own applications more simply as a result of language simplification.

The view has often been expressed that the expected improvement in mini-computer cost/performance, and the consequent trend towards decentralisation of processing power, will result in less computer/telecommunications than if processing power were fully centralised. However, it is suggested that trends are already evident which support the opposite case of an increasing need for computer/telecommunications. Examples are:

- terminal sub-systems based on mini-computers as part of an organisation's larger central system complex. While many of the system functions may be performed at the terminal end, management information and control functions will need computer/telecommunication links
- an increasing need emerging, evidenced by overseas banks and airlines, for the interconnection of users' computer systems. In some cases, the interconnections are occurring at the ends of the systems, between users' mini-computers
- data bases becoming decentralised, according to the extent to which they are accessed from different parts of the network. They may also be required to be accessed by terminals belonging to different organisations to a much greater extent in the future

6.4 DATA NETWORK TRENDS

As pointed out in Chapter 3 (Technical Futures) the present network has been designed basically for telephone operation. Data communication services are presently provided either through overlay networks (leased line data services, private data networks, the Common User Data Network, telex, public telegram service) or by integration with the telephone network.

There are a number of network possibilities for the development of data communications in the future, and these are considered below.

6.4.1 Switched Telephone Network. In its present form, the telephone network is capable of supporting a wider range of data services than those now provided, including for example, telemetry; information services; computer access; computer control; computer-aided instruction; remote shopping and banking. Also, the services which the network supports can be provided at almost any location in Australia at low incremental cost. These factors underline the desire to exploit the existing network to the maximum. However, a number of inherent characteristics can be expected to limit widespread use of the switched network for data transmission, including:

- the intrinsic error rate, which is of the order of 1 in 10^4 bits, this relatively high level being due mainly to impulsive noise in step-by-step exchanges. The present maximum transmission rate is 1200 bps (where circuits permit) and characterisation studies are now proceeding which will attempt to define the conditions under which this limit may be increased.
- connection set-up times, holding times and related equipment provisioning standards which are based on telephone conversation parameters. Present connection set-up times, ranging from 10–30 seconds, are expected to be inordinately long for some very short holding time data calls such as transaction messages which may require response times of the order of 100 ms. On the other hand, the very long average holding times of unit fee data calls from time-sharing terminals, presently about 15 minutes but with extreme holding times of up to four hours, are much greater than those of average telephone conversations, and could possibly cause network congestion should they proliferate.

For these reasons, it is believed that the future planned use of the switched network for data should be restricted as far as possible to those users whose operation would be suited by, and whose expected and/or measured traffic parameters lie within, the limits of telephone network design. These limiting parameters should be made more clearly known, and users unable to meet them should be encouraged to use private lines instead of the switched network for data transmission.

6.4.2 Private Data Networks. There has been a rapid increase in private computer/telecommunication or teleprocessing networks in Australia over the past five years. Currently, most of these networks are institutionally based, and this trend is expected to continue for the next decade. However, the amount of data communications between organisations is low, particularly between computer networks. For these reasons, current user needs are being met adequately by private lines, concentrators, multiplexers and polling techniques.

In the future, there will be increasing pressure by users to be permitted to make more effective utilisation of lines by sharing and switching of messages between users with a common interest. This view has been expressed repeatedly by all sections of the computer sector. While the Commission's by-laws have recognised the need to relax policies in this regard, it is considered that further and continuing liberalisation will be necessary to encourage innovation and efficiency in private network utilisation.

There appears to be sufficient evidence now to suggest that user demands in specialised industry groups for specialised computer/telecommunication facilities will increase dramatically in the future, and accordingly, a dramatic increase in the number of private data networks appears inevitable.

Within this framework, the establishment of any standards for user hardware will be extremely difficult to achieve, and it would be unwise of the Commission to attempt to set any. However, standards that would simplify ultimate network inter-connection, particularly interfacing and control procedures, should be encouraged. Such a move would have real significance in the likely long-term development of data communication facilities towards public data networks.

6.4.3 Public Data Networks. There are firm indications overseas that a requirement exists for different organisations conducting similar businesses to interconnect their data networks. The Austdata* study will examine the extent and timing of this development here. Also, a demand for more freely available interconnection could arise here from the expected influence of data bases, such as some library based information systems, which could require to be accessed directly by remote terminals belonging to a number of different organisations. These requirements for interconnection would best be met in the long-term by public data networks.

It is likely that short to medium-term public data network solutions in Australia will be directed towards providing improved data communication services, rather than interconnection of different customer systems. The move towards a switched public data network can be expected to be a longer term development, probably in the mid–1980s.

In the short to medium-term, the volume of data traffic on even the largest interstate route will not reach a level which would prove fully digital data transmission systems economic. However, demand for data communications in the medium to long-term must be assessed in the light of possible dramatic increases in computer usage as foreshadowed earlier. Generally, an increasing use of computers and data terminals which use digital forms of storage, processing, and manipulation, would seem to emphasise the advantages of providing a digital telecommunications capability.

Two special needs for public data network facilities in the future could be expected to include:

- long distance bulk data transfer between computers at high transmission speeds, requiring an error performance in the order of 10^{-7}
- mini-computer to host-computer transmission at speeds up to 9600 bps in the high density areas of the subscribers' distribution network, also requiring an error performance in the order of 10^{-7}

These two requirements, it is believed, provide the most justification for the establishment of digital data transmission facilities as the first step towards a public switched digital data network.

The switching technique will be one of the most important parameters in deciding the form of any proposed public switched data network. Both circuit switching and packet switching have support for various reasons, but to a large extent, the relatively short history of packet switching has not yet allowed all of the points made in its favour to be resolved. The two techniques are described in Appendix 1 to this Chapter.

A number of overseas networks have either been proposed, or have already been implemented. Some of these are wholly commercial, while others are entirely experimental and relate to studies of various types of both switched and leased public data networks. Also, only a limited number of international standards for public data networks have so far been agreed, these in the main relating to service classes, facilities and interfaces. It is understandable, then, that a wide variation exists at present in approaches to the development of public data networks, and in particular to the switching techniques favoured.

Nevertheless, a firm overseas opinion has emerged, favouring the establishment by about 1980 of leased line synchronous digital data services as the initial step in the long-term development of switched synchronous public data networks. The switching technique most favoured at present appears to be circuit switching, although a number of packet switching services, some commercial and some experimental, have either been implemented or are under consideration.

It is probable that both circuit and packet switching techniques offer certain advantages to both users and administrations that reflect the relative importance of a number of different parameters. These may include geography, data subscriber distribution, type of applications, tariff structure, inherent network reliability and error rate, and user traffic patterns. It may well be that a combination of circuit switching and packet switching might result in the optimum public data network for Australia.

It is considered that an in-depth study of both circuit switching and packet switching in a public network is necessary to assess the potential of these techniques for the Australian situation. The Austdata study will illuminate those applications best suited to a particular switching technique. The packet switching facility is available within the Common User Data Network, and more extensive use of it might be encouraged by tariffing policies to test its potential.

6.4.4 Other Networks. The transmission of data also takes place over private telegraph networks, the telex network and the public telegram network.

(i) *Private Telegraph Networks*. Although there are a number of extensive, low-speed private telegraph networks in operation, the growth in new networks is low. Tariffs in this area have not changed significantly for some time, although provisioning and maintenance costs have increased markedly. The profitability is therefore diminishing and the area of operation, as it now exists, is not expected to increase in significance in the future.

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*A major study of data services in Australia, being carried out by outside consultants. The results are expected early in 1976.

(ii) *Telex Network*. This network is expected to continue, possibly with some additional facilities, for many years. Its main advantage is that it operates with a set of standard international facilities, and with fully automatic working to most overseas countries. The telex network will provide a widespread, pervasive service to meet future terminal-terminal low speed requirements, with connection to computer based services if required. There are some advantages in integrating telex and data switched services, but the extent will depend on the cost structures of future data switching systems. At the present time, data system costs do not favour integration nor are they expected to for at least 10 years.

(iii) *Public Telegram Network*. This network is currently a heavy financial liability, and is expected to become an even greater one if the present operating method is continued. Losses can be reduced to a certain extent if some elements of the system can be automated: for example, the printergram, code addressed telegram and phonogram areas. However, such savings are probably minimal when compared with the expected wage rises in a labour intensive service.

Overseas administrations, faced also with spiralling losses in their public telegram services, have reacted in a number of different ways. For example, in Canada one of the largest common carriers has heavily automated and centralised its operation and has arrested its losses. Western Union and the British Post Office have recently increased telegram charges heavily. With increasing penetration of telephone and telex services in Australia, it is likely that telegram traffic will continue to decline to a basic level which can then be carried more economically on a more automated network than now exists. To this end, any movement of telegram traffic to alternative networks should be actively encouraged.

6.5 DATA SERVICES OF THE FUTURE

The joint development of computer and telecommunications technologies will enable the provision of networks capable of supporting a wide, flexible range of computer based data services. The purposes for which such networks might be used by individual subscribers are postulated below:

- in the simplest case, the use of interleaving techniques on broadcast television under viewer control, similar to the BPO CEEFAX system, to allow news and weather reports, stock market information, sporting results, theatre programmes and similar information to be displayed on the home TV receiver.
- the addition of a key-pad, which may be a push-button telephone, to allow a single news headline, for example, to be expanded to a more detailed display through interaction with a data base, similar to the BPO VIEWDATA system.
- an associated printer or facsimile device could be provided to allow a display to be converted to hard copy.
- as a further refinement, a computer terminal could be provided, consisting of a VDU and associated printing device. Such a terminal could allow access either to clients' systems for normal business information, or to time-sharing services for problem solving, over a network which could be the switched telephone network or a special data network. Such an installation could also allow remote shopping services, library services and education services through interaction with appropriate data bases, as well as the receipt of mail electronically. The terminal may acquire additional processing power and eventually be capable of standing alone for many of its applications.
- further increase in the computing power of micro- and mini- computers could extend the capability to work at home to many professionals: librarians, lawyers, architects, accountants, engineers. They would be able to access and update a variety of large data bases; to transmit to, and receive messages from colleagues and clients; and to organise remote conferences, both audio and visual, if required. An expanded range of education, entertainment and home services could also be available.

Services such as those postulated above are emerging, in one form or another, around the world. However, they are presented here only as examples of how developing computer and telecommunications technologies might be used jointly in the future.

6.6 SOCIAL ASPECTS

6.6.1 General. There is sufficient evidence to suggest that current popular beliefs that computers are unreliable, too complex, too expensive and difficult to use, will not be able to be sustained in the future. For some time, technological impediments will inhibit the effective and economic use of computers, but technology is expected to develop in such a way that, in the long-term, the computer will be in common use. The joint computer/telecommunications technologies involved are expected to have a critical impact on future economic and social development, and any impediments to effective computer utilisation which do occur are likely to be economic, social and political.

Regardless of the possible economic advantages of computer technology developments, other difficulties may arise in the future due to the unwillingness of people, for a variety of reasons, to communicate with and use computers. There may be concern about the uses to which computer technology and data communications may be put to satisfy organisational, institutional and even short-term national goals which could well be at variance with long-term adaptive goals. Some of the main issues and concerns are discussed below.

6.6.2 Fragmentation of Responsibility and Dissociation. Organisational factors are crucial in determining the social utility or adaptiveness of data services. A fundamental choice exists between the design of centralised networks operating within a bureaucratic (i.e., specialised and hierarchical) goal framework and the design of decentralised non-specific systems serving human goals or purposes.

To the degree that data services are used in a centralised framework distributing data to serve institutional goals, individual and group responsibility, already under pressure, will continue to fragment. As individuals are increasingly acted upon by computerised requests or orders (e.g. bills, movement orders, maintenance schedules, etc), they will increasingly dissociate from human interaction as a means of attaining goals. Coupled with the rejection of responsibility which computerised services inevitably encourage in a bureaucratic organisation (e.g., the oft quoted plea 'It's not my responsibility, Madam, the computer "did" it') strong forces toward increasing individual dissociation and fragmentation of responsibility will be generated. These forces may be manifested in increasing cynicism, privatisation, vandalism and violence.

However, adaptive forces in society will be aided by the degree that data services and computer power are effectively designed to simplify co-ordination and control, for example in industrial control and 'management by exception' procedures.

The highest priorities for improved computer/telecommunications would appear to be:

- industrial co-ordination and control from remote points (high speed, high reliability machine-machine communications)
- access to government, semi-government and private registries and associated information stores (high capacity man-machine communications)
- national model building (high capacity man-machine and machine-machine communications)

These requirements support the need for a digital transmission capability as suggested in Section 6.4.3.

6.6.3 Information Overload. As man increases his control over the physical environment he is faced with the problem that this control presents him with an almost infinite range of interactions which might be relevant to his continued efficiency. However, his ability to sense and accept information about these interactions is finite and biologically limited. The use of computer/telecommunications systems to increase control may simply push the amount of information being received over the threshold of information overload. If this occurs, stress reactions will be produced which will eventually lead to a lessening of dependence on distributed information.

Once again, it is the organisation aspects that are crucial. The large company or institution, characterised by areas of specialisation, hierarchical organisation and centralised decision-making, requires a vast and continuous information exchange. The information overload which will already exist at various levels tends however to be limited by the relative inefficiency of human information systems. If, however, computer-based centralised management information systems are introduced, which reflect the traditional organisational needs, they will multiply the information available at any decision-making point without providing any improvement in the individual's ability to use that information selectively. These are conditions which inevitably lead to information overloads and personal stress—even today the attrition rate through stresses in individuals who are at the focus of organisational information flows is evident. Extension of existing organisational forms coupled with improved computer/telecommunications technologies are likely to increase this attrition.

6.6.4 Privacy and Access. Regardless of technological and organisational standards or judicial and legislative constraints, it must be stressed that a growing proportion of the population is becoming concerned with intrusions into private life. Although specific recommendations may be made about protection of privacy, the recommendations must be understood as only part of the answer. People have strongly different attitudes to privacy and no recommendations about safeguards will allay the fears of all of the people all of the time. Overall, therefore, a process of continuing regulation plus a core of legislation would appear to be the most appropriate response. The importance of an open and continuing process of privacy regulation and review cannot be stressed too much. Fixed, immutable legislation would appear to be inappropriate for the successful adaption of concepts of privacy.

The linking of privacy and access at a regulatory and legislative level would appear to be a mandatory requirement. One could argue, in fact, that the so-called right to privacy is best expressed under four categories, each of which is potentially realisable, whereas an overall right to privacy is not. The categories are:

(i) right of access— (a) to the planning of the system
(b) to the working system

(ii) right of notification—for example, either regularly, automatically, or on request

(iii) right of redress— (a) ability to challenge
  (b) ability to erase and/or modify
  (c) opportunity to gain compensation, which implies the existence of a regulatory framework

(iv) right of control—which information can be released to whom.

A number of Australian States have formulated legislation in this area, some of it based on recommendations contained in the Morison Report (1973). However, to date there is no specific national legislation addressed to this topic.

6.6.5 Security and Control. There will need to be secure control over access to computer data bases to minimise the problems outlined above. It will be imperative that such control be exercised selectively within the computer system as far as possible.

For example, some time-sharing systems exist in which access to particular files for purposes of reading, writing, updating or executing can be granted and withdrawn selectively. If internal control methods cannot be developed, and traditional methods of control, including individual program checking, are needed, control generally is likely to become more and more centralised.

This problem notwithstanding, security and control will need to become more elaborate. It will not be sufficient to specify who may access a particular file; it will also be necessary to restrict the amount of data which may be extracted. Unfortunately, there is likely to be an economic implication in arriving at the degree of security and control considered desirable. It is a fact that computer systems cannot be made absolutely secure—they can only be made more secure and at a higher cost.

6.6.6 Standards and Regulations. Agreements should be sought through existing bodies such as CCITT, ISO, OECD and others, on guidelines for the setting of standards relating to privacy, access, security, the exclusiveness of proprietary data and the re-definition of copyright in a computer based environment. In particular, principles should be established internationally that personal data originating in one country must not be used in another country for purposes other than those originally intended and made known when the data was initially obtained.

The monitoring and enforcement of standards and safeguards for data protection should be the role of an independent mediatory body, with the back-up of any necessary, meaningful legislation.

6.7 CONCLUSIONS

Developments in computer and telecommunications technologies over the past decade have resulted in dramatic increases in growth of data communications. An ever closer partnership between computing and telecommunications in the future appears inevitable. While the outcome hopefully will be the development of a wide range of new and desirable data services, nevertheless a number of problems can be foreseen.

Consideration of questions relating to the development of effective standards for the two sectors, together with matters of concern regarding issues of privacy, access, security, and the rights of users, are crucial to the development of joint computer/telecommunications networks. The networks themselves are expected to remain primarily institutionally based for the next decade, although an increasing requirement is foreseen during this period for organisations to interconnect. This is expected to lead to a requirement for a public switched digital data network in the post 10-year period. Switching and other techniques to be used for such a network will need to be agreed through studies conducted during the next few years. In the meantime, the switched telephone network will be used to an increasing extent for some data applications, but the limits for its use for data purposes will need to be clearly established.

RECOMMENDATIONS

With these issues in mind, it is recommended that:

1. The Commission take a leading role in developing machinery to foster the harmonious development of the two sectors and that this be done in three ways:

(i) By initiating the formation, at Government level, of an Australian organisation operating through 'open' enquiry and comprising representatives from the Commission, telecommunication and computer manufacturers, the public service sector, other users, and the general public; this organisation to examine:

  (a) the formulation of joint national interworking standards, extending beyond the technical issues identified as the Commission's responsibility, and aimed at facilitating inter-connectability and compatibility in the long term.

  (b) the effect, on total national resources, of the different rates of innovation and depreciation in the two sectors;

  (c) questions of privacy, access and the rights of users.

(ii) By continuing to press for agreement through international bodies such as CCITT, ISO, IFIP, OECD, and others on the setting of standards relating in particular to privacy, access, security, the exclusiveness of proprietary information and the redefinition of copyright in a computer-based environment.

(iii) By supporting the formation of an independent mediatory body, which may or may not be the same as (i), backed by meaningful regulation and/or legislation as necessary; this body to monitor and enforce standards and safeguards for data protection.

2. The Commission closely re-examine its terminal policy in the light of the expected increase in the use of various types of remote terminals connected to telecommunications lines.

Such re-examination should consider:

(i) The market size at which the future provision of standard terminals will be a viable proposition for special purpose applications.

(ii) Whether, in an endeavour to conserve capital, some terminals, particularly those subject to a high rate of obsolescence as a result of rapid improvements in technology, should be sold to customers over a short term period, rather than leased over a much longer term.

(iii) Whether the Commission should provide a maintenance contract with standard terminals, possibly with provision for different charges for different service restoration times.

3. (i) Current network characterisation studies to determine the extent to which the existing network can support a wider range of data services, being vital to data planning, receive a high priority and resources so that the task may be completed quickly.

(ii) The future planned use of the switched telephone network for data services take much more account of the operational and traffic parameters of data users, to determine the extent to which they may differ from normal telephone network design parameters.

4. The Commission increasingly respond to user needs through further liberalisation of policies relating to innovation and efficiency in private line utilisation; examples are the current moves to liberalise policies relating to sharing of leased lines and integrated modems.

5. (i) Recognising the general long-term trends towards digital telecommunication networks, and the particular advantages of digital operation for data services, the Commission give priority to the provision of a digital transmission capability on those junction and trunk routes having the greatest data traffic potential; this would enable experience to be gained with the technology of digital data transmission, and would be the first step towards the provision at a later date of a public switched digital data network. Demand estimates should take account of likely traffic stimulus resulting from reduced data tariffs that might be possible when digital transmission systems become effectively loaded.

(ii) An in-depth study of both packet and circuit switching techniques for the Australian data environment be carried out. Such a study should consider the case in which a combination of circuit and packet switching techniques is used, to determine whether such a switched digital network might best suit Australian conditions.

6. (i) Recognising the role that computers will have in the future widespread distribution of information, the Commission maintain its present monopoly of public common carrier networks in the case of computer/telecommunications.

(ii) The Commission support the principle that separation of the telecommunications and data processing sectors is desirable for social reasons to limit the size and power of a large institution.

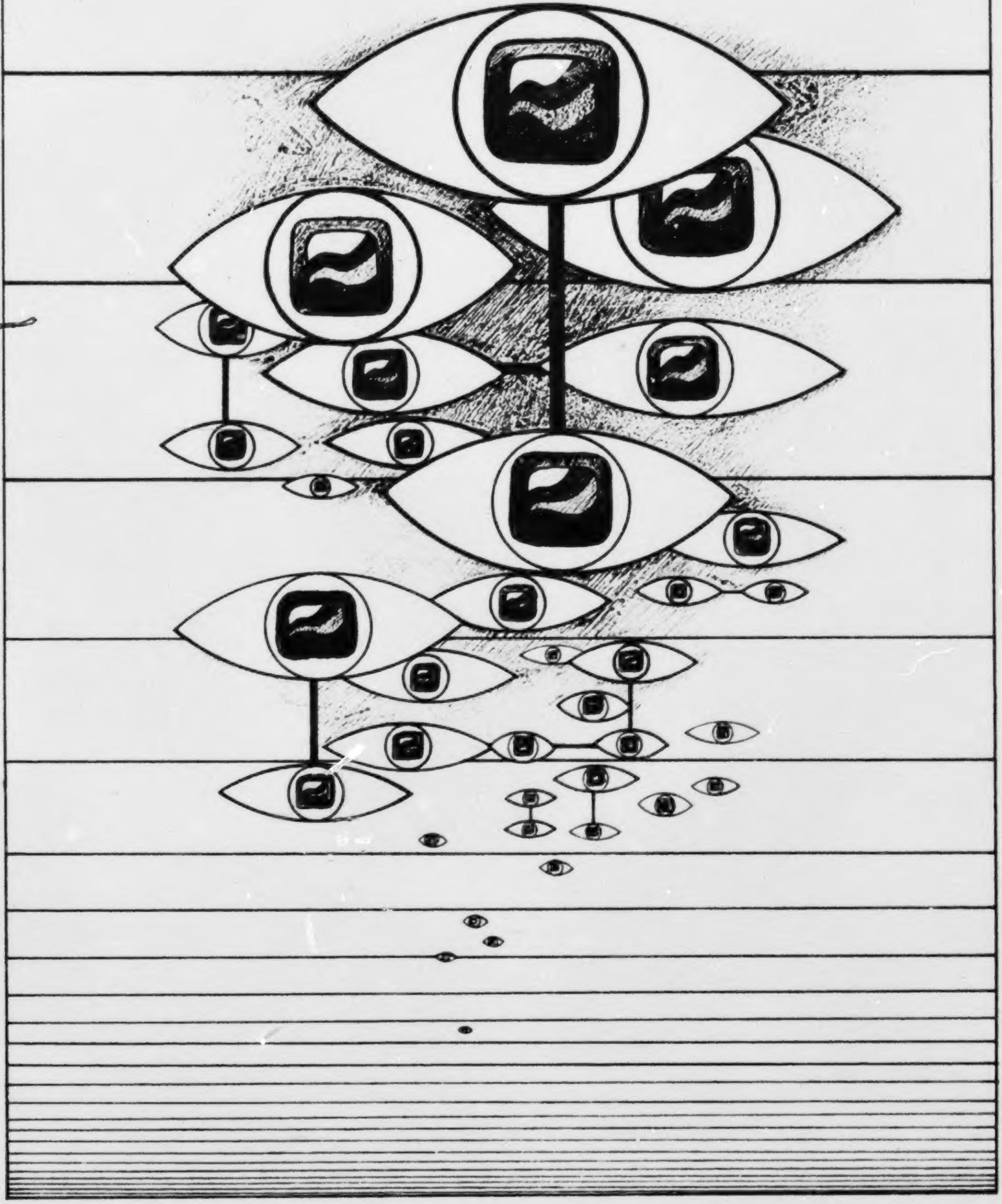
APPENDIX 1

The main characteristics of circuit switching and packet switching techniques are:

Circuit Switching enables the establishment of an exclusive connection, on demand, between calling and called terminals. Set-up times are longer than in packet switching networks, and where the called terminal is heavily utilised, calls are difficult to establish. The technique will not be attractive in those applications where transmission times will be short by comparison with set-up times. On the other hand, the long holding times of computer-computer connections will favour circuit switching. Circuit switching costs are expected to be significantly less than packet switching costs.

Packet Switching, a sub-set of message switching, enables transmission of a message in the form of discrete addressed packets between calling and called terminals under the control of the switching system, but no direct connection is necessary between terminals, since the message is stored at intermediate switching points. The technology was developed specifically to improve data communications by improving response time, reliability and error performance. The technique is likely to find more support in the future, when terminal-terminal traffic seems likely to decline in favour of terminal-computer and computer-computer traffics. However, packet switching is still only in its infancy, and some overseas administrations have raised doubts as to its viability. In fact certain administrations, together with large computer suppliers including IBM, have fixed firmly against it for reasons that, unfortunately, have not always been made clear. Finally, packet switching system costs are expected to be significantly greater than circuit switching costs.

7. VISUAL TELECOMMUNICATIONS



7.1 INTRODUCTION

This Chapter briefly discusses the potential for development of visual telecommunications services. In this context, visual telecommunications refers to person-to-person or group-to-group services which utilise two-way video images. This definition excludes broadcast television or cable television and visual display data services which have been discussed in some detail in other chapters. Although cable distributed television has been proposed by some writers as the forerunner of switched video services, this conjecture cannot be supported by likely developments in cable television technology. Point-to-point switched visual services require a much greater transmission capacity than a television service broadcast over a cable. Future switched video telecommunications networks, if provided on wideband transmission media might, however, support cable distributed television.

Since the introduction of telephony, forecasters of telecommunications development have been confidently predicting the introduction of a visual image to accompany the audio telephone signal. These predictions seemed to be coming true when several telephone authorities began to experiment with video telephones soon after the advent of entertainment television. These experiments gave rise to several video telephone networks trials, the most publicised example being the Bell Telephone Company's 'Picturephone' service first introduced in the early 1960s.

However, the earlier expectation that a video telephone service would be an effective substitute for face-to-face communication for most situations was not met. The video telephone systems were not universally greeted as a major improvement on the audio telephone. Technical shortcomings such as lack of definition, small pictures, limited ability to transmit detailed documentation or graphics, and the high cost of the service, disenchanted potential users. But there was also evidence that the psychological, organisational and social ramifications of visual telecommunications were not sufficiently understood. The technical problems of definition and adequate display are capable of solution and technical advances offer prospects of significant reductions in cost within a decade, but there are still many social problems which remain to be investigated.

7.2 SOCIAL FACTORS

Although some research is also being undertaken around the world to evaluate the effectiveness of person-to-person telecommunications both in comparing differing modes and in comparison with face-to-face communication, this research is only beginning to come to grips with the issues involved and a great many questions remain to be answered.

The current community experience of television is confined to passive uses of the medium, as a one-way entertainment or display device. The community response to visual telecommunications, or other forms of interactive television such as might be provided by augmented cable television systems, is likely to be heavily influenced by a framework of values, expectations and predispositions which are derived from television viewing. Values such as status, expectations about technical standards derived from the production standards of entertainment television, and the disposition of the community to regard the medium as passive, rather than active, are examples of this framework.

The following discussion of the effects of video displays for visual telecommunications services covers four areas, namely, the ability to impart knowledge, societal effects, organisational effects and physiological effects.

The video image of any particular object does not transmit the contextual environment of that object to the viewer. The image therefore does not convey total knowledge about that object in such a way as to allow complete understanding of the object in its environment. For example, a videophone service which displays only the caller's head and shoulders leaves the called party in doubt as to who else may be in the room with the caller. This limitation of contextual relevance may not, however, be restrictive for those uses where the surroundings are of limited relevance, for example, in showing documents.

Extended periods watching or operating visual telecommunications services tend to increase social isolation. Working in 'home offices', for example, with informal interactions restricted by the constraints of the media and taking part in leisure activities which entail watching entertainment television, as has been suggested in some forecasts of the future, would tend to reinforce isolation, and the dissociative social trends discussed in the chapter on social futures. This trend could be partially offset by utilising visual telecommunications facilities for interaction with other members of the community, rather than as a one-way channel. This could be accomplished for example, by providing opportunities for competitive participatory games, or ensuring that each user has access to other members and information sources within his community of interest.

The application of visual telecommunications to present business or community communication needs is dependent on current organisational form. Experience in the USA with the Bell 'Picturephone' has shown that the use of the service is heavily dependent on the manner in which it is applied within the structure of the organisation; that is, the service must satisfy a communication need which realises the potential of the visual communication, rather than being provided as a status symbol. Future business organisations may utilise the full potential of visual telecommunications to realise the benefits of both geographical and functional decentralisation.

Experience with entertainment television suggests that there is a range of positive benefits and negative results from extended viewing of the video image. Recent limited evidence suggests that prolonged exposure to video displays may have extended adverse physiological effects. These effects, if proven, match the known negative effects of video displays at the psychological, social and organisational level. Considerable research is necessary to investigate the range of effects of video displays, with replication of existing tests extended to include a greater range of subjects over a wide range of situations.

7.3 TECHNOLOGY

The display methods for visual telecommunications services presently depend on cathode ray tube technology. Despite the innovation introduced by the impetus of entertainment television, existing visual telecommunications equipment is restricted by the size, optical constraints and power requirements of the high voltage cathode ray tube. On the other hand, the community is becoming increasingly familiar with video display and recording, and exploring the use of the medium for personal and community benefits. This familiarity with the medium may place considerable pressure on the telecommunications authorities to provide a network to link together individual video systems, more especially if the technological developments reduce the size, and cost, and increase the availability of video equipment.

Such developments include:

- the cost and size of cameras drastically reduced by new developments in solid state technology; e.g. charge-coupled device matrices and other direct optical electronic interfaces which will not require bulky and power consuming cathode ray tube support.
- displays utilising matrix display on flat screens which may be especially applicable to digital excitation and therefore data display. These are expected to replace cathode ray tubes within 15 to 20 years as the common video display medium.
- digital transmission offering opportunities for the application of coding techniques to improve the information-bandwidth ratio of transmission systems for wideband services and provide greater utilisation for existing line plant.
- new cheap transmission media such as optical fibres which may provide a wide bandwidth communication highway into subscribers' premises.

7.4 VISUAL TELECOMMUNICATIONS SERVICES

The two best known visual telecommunications services are videotelephony and videoconferencing. Although both services have been initially forecast as being of greatest use in the business area, research experience in Australia and overseas suggests that person-to-person videotelephony does not offer as much immediate benefit in that area as videoconferencing, and each service has aspects of operation quite different from the other.

The Bell 'Picturephone' was established using a 1MHz bandwidth (1/5th of the bandwidth of entertainment television). Many users of the service were disappointed by the limited ability of the system to display documents or computer generated alphanumeric data. Similar shortcomings were also evident in other trials of videotelephony in Britain, Japan and Europe.

There is evidence overseas that improved techniques of resolution and image transmission are overcoming the technical shortcomings of the original 1 MHz bandwidth service, and these point towards cost reductions in the future. Most telecommunications authorities are hesitant to introduce the service into the network at present because of unknown factors of acceptability. They are relying instead on a programme of field trials of various configurations over a range of communication situations, to indicate the likely trend.

The experience of videotelephony to date has shown that the transmission of documentation within the organisation is a greater attribute of the system than 'face-to-face' communication. This result suggests that there is a demand within business organisations for rapid transfer of dynamic documentation, that is, documents which can be altered, referred to or otherwise operated on during the conversation. A real-time video display with its attendant, expensive, wide bandwidth transmission circuit may not provide an optimum solution. A cheaper form of videotelephone which displays a continuous series of higher resolution still pictures at each terminal at intervals of, say, 45 seconds over the switched telephone network may more adequately satisfy the demand.

This fixed frame technique which trades transmission time for bandwidth has been experimentally applied to remote lecturing in the educational field overseas, for example. RCA are actively marketing a oneway service, 'Videovoice', for commercial use.

The consensus on videotelephone development is that a videotelephone service is not marketable as a public switched facility until more complete understanding of its effectiveness and utility has been gained. A range of field trials of various configurations in various organisational situations offers the best means of answering marketing questions such as: when, if at all, how and in what form, and at what cost?

The initial demand for videotelephony is expected from business organisations in the form of small private in-house networks. As these networks become more common, a demand could arise for interconnection between networks. These interconnections could form the basis for a growing public videotelephone network, as could the extension of videoconferencing.

7.5 VIDEOCONFERENCING

A recent development in visual telecommunications, video teleconferencing, conceivably provides a more immediately useful tool for business operation. A network of teleconferencing facilities can be provided to enable conference groups in distant centres to be connected together by visual telecommunications media. The Commission at present operates a service of this type called Confravision between conference facilities in Melbourne and Sydney. Limited services are provided in UK, Canada, USA, Japan and Europe.

Evidence is mounting from these developments that video teleconferencing is a communication innovation in its own right, generating a variety of new uses and possibilities for group interaction over distance. It seems that such tasks as ordered discussion, information and opinion exchange, and technical problem-solving are appropriate to the system, whilst tasks which concern conflict, personal and emotional matters or brainstorming requiring higher levels of personal interaction are seen as less appropriate. Since the videoteleconference system has been rarely used for these latter, more complex activities, these responses may represent a conservative approach to a new system.

The videoconference, for intra-urban, intra-state and interstate situations does offer greater flexibility of organisational operation, and hence potential savings in time, cost, fuel and energy. These advantages increase with distance, depending on the structure of service tariffs.

Despite earlier predictions that visual teleconferencing would provide a substitute for travel, in particular business travel, research in UK, Canada and in this country with videoconferencing suggests that it complements, rather than directly substitutes for, travel. In particular, videoconferencing is enhanced if the participants have previously met face-to-face.

This service also introduces the community to interactive video communication on a personal basis and overseas forecasters see this service as an important step toward the introduction of switched person-to-person videotelephony. Additionally, video teleconferencing provides an excellent opportunity for research in many of the social, technological and psychological aspects of visual telecommunications.

In Australia, with its long distances between population centres, economics will particularly favour the telecommunications solution to problems of distance, since transport costs will rise with increasing speeds, energy consumption and labour costs. Introductory tariffs may be set to foster usage under these conditions, with the long term tariffs dependent on the reduction in network costs by technological improvement.

The demand for videoconferencing would partly be dependent on the move toward decentralisation, including the decentralisation of administration from the central business districts and industrial zones and the possible establishment of neighbourhood work centres. This decentralisation would be consistent with a network of video links in the local network reticulation area, as well as the trunk area. Considerable interest in the use of videoconferencing in the development of new urban areas has been shown by several Government departments. Similarly, rapid connection of other centres to the existing Melbourne-Sydney service has also been suggested to take advantage of the benefits the service offers. In particular, enquiries have been received as to the likelihood of the connection of a Canberra facility to Melbourne and Sydney, as an aid to Governmental communication.

The degree of interest shown in Confravision by the users of the present Melbourne-Sydney services, and the growing emphasis overseas on video teleconferencing, suggests that the Commission should engage in a market research exercise to more accurately gauge customer reaction, more effectively programme extension to the service if the demand requires, and provide the necessary basis for a marketing strategy if the facility confirms expectations of profitability.

The possible network strategy to cope with a high demand for videoconferencing is:

- provision of a public Confravision service between capital cities, commencing with a service to Canberra as soon as practicable, capable of connection to the present Melbourne and Sydney facilities
- encouragement for the establishment of videoconferencing facilities in private organisations capable of being switched on to the Confravision network
- extension of the Confravision network to growth centres
- extension to large community centres, remote industrial or mining establishments, etc.

A high penetration of videoconferencing would require a dynamic network capable of meeting a fluctuating demand, both between centres such as capital cities which may be expected to generate a considerable demand, and centres which are remote and hence not close to existing broadband facilities. This fluctuating demand may be best satisfied by the use of demand-assigned satellite circuits.

The remoteness of the Australian continent from other centres of commerce offers a particular opportunity for international videoconferencing. International operation raises problems of technical standards, but these problems may be simpler to solve when videoconferencing is in its formative stage. The technical feasibility of such links was demonstrated recently by the operation of an experimental videoconference with the British Post Office over a link between the Sydney Confravision terminal and a UK studio.

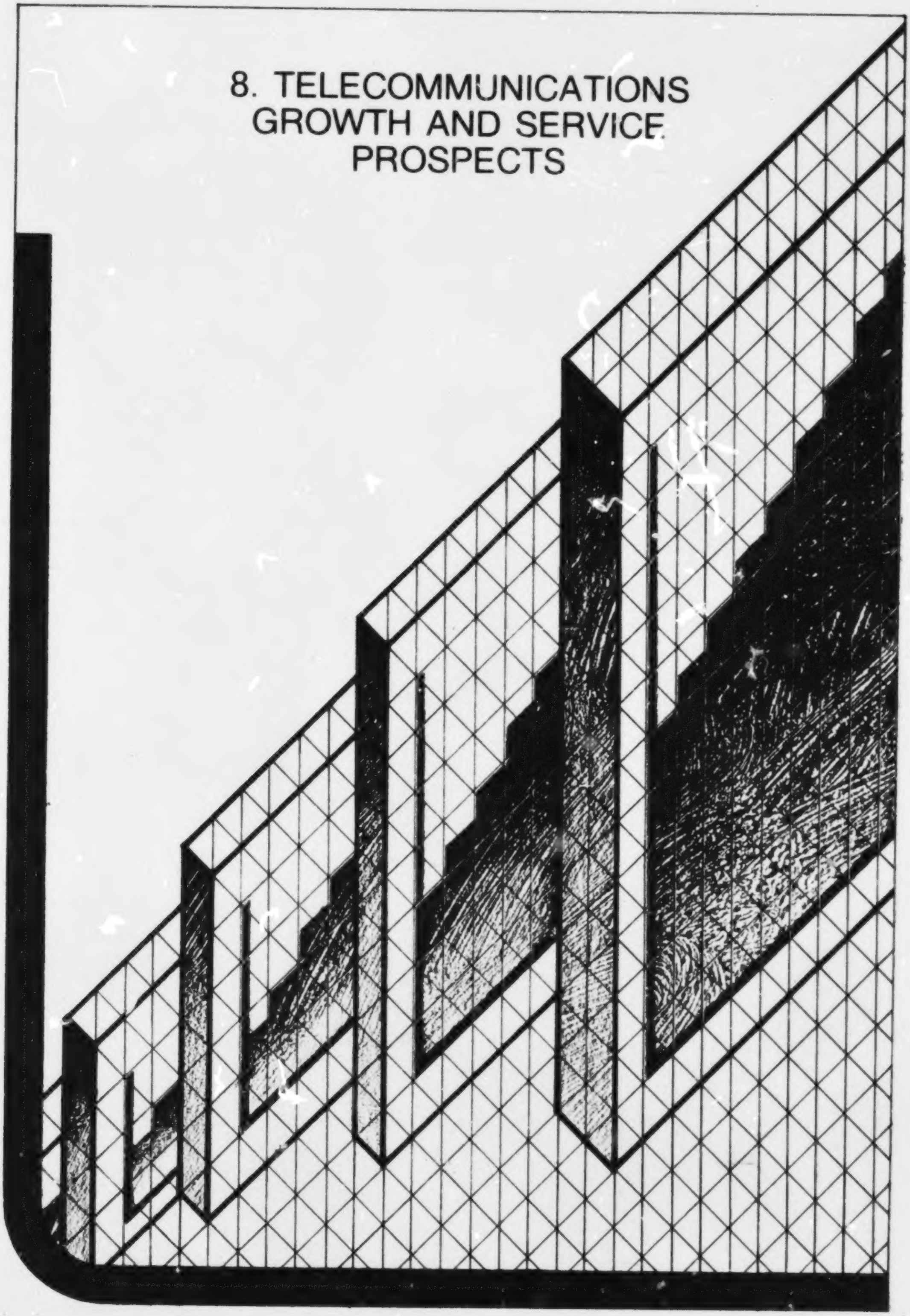
RECOMMENDATIONS

Although videotelephony has not fulfilled its early expectations, the growing worldwide interest in the use of videoconferencing suggests that the Commission can expect continuing developments in visual telecommunications, and that these developments may offer new markets to supplement existing telecommunication services.

On this basis, continuing interest in the field of visual telecommunications is warranted and it is recommended that:

1. (i) All aspects of visual telecommunications be closely monitored until the directions of development are more clearly established.
   (ii) The Commission include experimentation with various forms of visual telecommunications in any programme of field research.
   (iii) In addition to field research, a programme of research into the positive and negative effects of visual telecommunications be implemented, embracing economic, psychological, physiological, social and organisational aspects.
2. (i) Trials of Confravision should be continued with an active marketing approach designed to generate increased community interest, with Canberra included as an additional centre, capable of connection to either existing Melbourne or Sydney facilities.
   (ii) A market survey be conducted to establish the trends in demand for Confravision services.
   (iii) Planning proceed on the assumption that an all-capital city facility will be introduced by the early 1980s utilising demand-assignment techniques on a domestic satellite system. The decision to proceed with implementation would depend on the overall satellite system economics with added Confravision capability.
   (iv) Users of the service be more involved in the design of the next-generation equipment, to establish a balance between technical excellence (and hence cost) and utility.
   (v) The Commission explore the possibility of introducing international videoconferencing. (The technical feasibility of such links was demonstrated recently, as a result of an experimental videoconference with a UK studio.)

8. TELECOMMUNICATIONS GROWTH AND SERVICE PROSPECTS



8.1 INTRODUCTION

This chapter examines the growth of existing telecommunications services and the demand for potential new services. In recent years there has been much speculation on the wide range of possible new telecommunications services operated over existing networks or new wideband networks. Provision of visual, hard-copy record and computer-assisted terminals could, conceivably, make available hundreds of different specialised services in fields such as media, news and information, business and commerce, health and welfare, entertainment and education. Some examples are given in the list which follows:

Visual Services
- video telephone
- videoconferencing
- augmented cable television (CTV)
- educational — broadcast or interactive
- library display
- stock market
- transport time-tables
- entertainment programmes
- theatre bookings by viewing plans
- newspaper column selections — news, sports, advertisements
- remote shopping

Computer-assisted Services
- computer-aided instruction
- computer-aided design and operations
- access to data bank information —legal precedents, medical diagnosis, etc.
- selective advertising search
- household and office management
- remote reading of household utility meters
- advanced burglar and fire protection

Hard Copy Services
- telemail
- reproductions of reference material — archival or transitory — e.g. home reproduction of newspaper extracts
- ticketing services

Mobile Services
- personal two-way voice or data terminals connected to the telephone network and carried in pocket or vehicle
- paging
- mobile facsimile, data and coded-message services
- public transport; telephone in buses, trains, ships, etc.
- guided highways
- integrated traffic control systems

Some of these services already exist in various forms, suggesting that a demand for increased information access is already well in evidence. Although some of the visual telecommunications services in this list, such as videoconferencing and videotelephony, require the provision of new wide bandwidth networks, the provision of suitable display terminals and information sources would nominally enable a voice bandwidth telephone network to provide the remaining services.

It is possible that certain services as they are known now will not appear in the same form towards the end of this century. Hardware could be amalgamated to provide multi-purpose telecommunications services (e.g., videophone incorporating the present telephone service facility). Likewise, forecasts of the growth of individual services will become less relevant as their unique identity changes. This will be due to the impact of new services on existing ones (e.g. facsimile on telex or mail). New developments in telecommunications facilities are likely to gain first acceptance in the business area.

8.2 FORECASTING

For other than well established services, long-term forecasting is extremely hazardous. Normal market research is of little use in attempting to forecast long-term demand for non-existent services. There is, however, a formidable array of techniques available to assist in forecasting technological development. Some of these are based on extrapolation of past results, whilst others, like Delphi studies, rely on consensus of expert opinion. A further group of forecasting techniques describes future developments in terms of prescribed future goals, and assesses the options generated by examination of each of these futures or scenarios. A number of these techniques have been, and are being, applied to forecasting new developments in telecommunications and allied technological areas.

Indirect approaches which involve social modelling and the investigation of the limiting uses of established services may reveal new insights into future demand. Studies have commenced in these areas (e.g. Professor Encel's work under contract) but it will be several years before fruitful findings can be expected. The Austdata study (see also Chapter 6) uses a combination of advanced market research and long-term forecasting techniques. These studies, coupled with field research, should throw considerable light on future demand for new services.

Collectively, these approaches should enable more dependable forecasts to be made in subsequent years. Meanwhile, the best that can be done in forecasting future services — particularly advanced data, facsimile and visual services — is to make conjectures regarding feasible upper and lower bounds, based on alternative sets of assumptions about economic, demographic, social and technological factors. This approach makes use of some of the techniques discussed above in forecasting the capability, timing and costs of future technology, and of proceeding by analogy with the development of known services, at home and abroad, within the likely social and economic frameworks forecast at the macro level in Chapters 1 and 2.

In these circumstances, the upper and lower bounds are not forecasts in the accepted sense, to which statistical confidence levels could be applied, but reasoned and credible limits of demand potential. Their utility is to indicate the broad scope of potential markets, and the financial and other implications if either a very high or very low demand eventuates for each service. It must be realised that these upper and lower bounds are not directly comparable between different services, since a very high demand for one service, facsimile, for example, may significantly suppress the demand for another service, say telex.

8.3 GENERAL COMMENTS ON GROWTH

Penetration of telephone services should rise considerably between now and the year 2000 by which date practically all residences should have a telephone service. Factors consistent with a greater penetration are rising personal incomes and an increasing social dependence on the telephone, possibly recognised by future Government subsidy of the basic telephone service as an essential reticulated utility. If the unfortunate experience in some other countries is repeated here, then rising urban congestion, crime and fear of violence may contribute to increased telephone usage as a substitute for local mobility.

With this approaching saturation of domestic telephone service, the rate of growth will decline to less than half the present level, with the initial effects of the decline becoming apparent in the coming decade. There will be a gradual but important change in the mix of telecommunications business. While telephone growth declines, other services will expand at much greater rates. Investment for newer services will represent a growing proportion of future capital expenditure and the overall profitability of telecommunications is likely to depend increasingly on these new services.

8.4 DECENTRALISATION

A telecommunications service which provides a wide range of facilities presents an opportunity to decentralise both the functions and the physical location of many organisations. The neighbourhood work centre, the home office, community information centres, decentralised business districts and new growth centres are all possible examples of future decentralisation. They will depend to varying extents on a multifunctional telecommunications network providing information retrieval and distribution, and personal interaction over video links. This, in turn, would allow some substitution for physical movement of goods and people.

8.5 EDUCATION, HEALTH AND WELFARE

An increasing demand for a range of telecommunication services in the fields of education, health and welfare is likely. This can be expected in view of what seems a general desire that equality and convenience of access to the benefits available are not denied communities disadvantaged by physical, economic or ethnic constraints. Health care, for example, might be complemented by the provision of community paramedical clinics connected to a range of reference specialist centres by telecommunications links. In education, much has been said about the ability of telecommunications to provide equality of access for all students, including extended education for adults. A pilot study by consultants on the inter-relationships between all forms of education and the developing telecommunications services of the future was initiated by NTP to assist in developing forecasts in this area. This study concludes that while there is a high long-term potential for telecommunications in education, the rate of development will be constrained by resolution of basic issues about educational aims and goals, institutional problems and lack of agreement on curricular and other standards.

8.6 THE GROWTH OF EXISTING AND FUTURE TELECOMMUNICATIONS SERVICES

Appendices to this chapter outline the basis of the forecasts (for established services) and conjectures of development (for future services) through to the year 2000. The range of diverse services possible is extremely large (e.g. different speeds, display devices and information sources), but for present purposes they are condensed into the following generic classes:

Telephone Services	Appendix A
Telex	Appendix B
Data	Appendix C
Facsimile	Appendix D
Teleconferencing	Appendix E
Videotelephony	Appendix F
Mobile Services	Appendix G
Cable Television	Appendix H

The results (except for teleconferencing) are summarised in the following charts. Fig. 1 presents credible limits of demand at 2000 for each of the various services considered, while Fig. 2 represents the probable range of total capital investment which may be required over the 25 year period 1975–2000 (at 1972/73 prices) to provide for the demands. Whilst investment does not include the cost of international telecommunications facilities, which are the responsibility of the Overseas Telecommunications Commission, it does include the national network costs of handling international traffic.

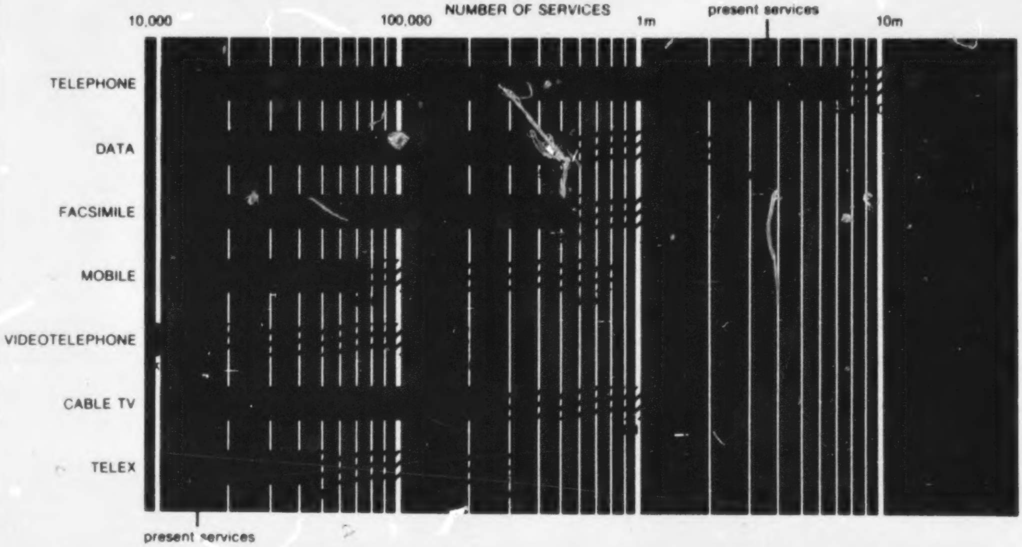


Fig. 1. Possible range of telecommunication demand—year 2000

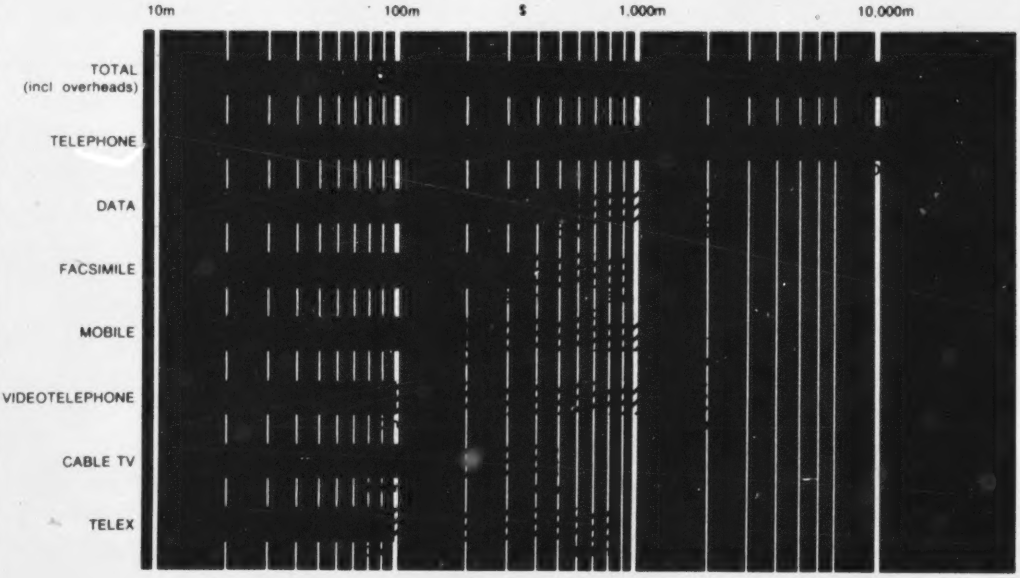


Fig. 2. Possible range of aggregated telecommunication capital investment 1975–2000

Future discussion on the financial viability of services, as well as the significance of the total estimated level of capital expenditure for these services, is contained in Chapter 10. Important factors affecting the introduction of each of these services are discussed in Chapter 9. Finally, it should be re-emphasised that these are not estimates of demand, but an examination of the boundaries of likely demand, within which a forecast of demand might lie. Only in the case of telephone, telex and, to a smaller extent, data, is any historical growth information available on which to base forecasts. For other services, various forecasting methods have been used to develop the limits of likely demand. These examinations represent a basis from which a more effective forecasting methodology and more definitive forecasts can be developed.

8.7 GROWTH OF PUBLIC NETWORK TRAFFIC

The bulk of public network traffic is, and will continue to be, telephony generated but the proportion of traffic from new services, including data and facsimile, is expected to grow rapidly.

The total traffic generated in local networks can be expected to grow as new subscribers are connected to the network. Although new subscribers can be expected to have less traffic-generating potential as telephone penetration increases, this will be more than counterbalanced by a general increase in residential telephone calling rates due to the increase in long distance traffic and the number of new information services available on the switched telephone network. Hence a continued total traffic growth of 6% per annum is forecast through to the year 2000.

Traffic on the telephone trunk network is expected to continue to increase at the present 12% per annum for at least the next decade, gradually decreasing to a growth of about 8% per annum at 2000. The trunk telephone traffic growth will be supported by increasing mobility of the community, development of inland areas of Australia and an increasing accessibility of the Australia-wide market to business organisation.

International telephone traffic today represents less than 1% of Australia's long distance traffic, but its growth potential is high. International traffic originating and terminating in Australia has been growing at a rate of 30% per annum, approximately 2.5 times the growth of national trunk traffic. Improvements in international network operation arising from technical developments provide an opportunity for tariff adjustment to sustain this rate of growth for at least the next ten years.

The bulk of this traffic is generated by business, stimulated by growth in international commerce and travel. However, at the close of the 1980s, the growth may be more dependent on the amount of international traffic generated by non-business sources, and is expected to diminish gradually to about 15–20% per annum by 2000. At that date the level of originating international traffic would correspond to about 8% of total long distance traffic.

8.8 GROWTH OF PRIVATE LINES AND MISCELLANEOUS CIRCUITS

There is a growing demand for cable pairs and long distance circuits to serve communication needs other than public network services. Data lines, telemetry circuits, control circuits, alarm and supervisory services are expected to proliferate with the growth of private networks and the development of facilities with greater capability and increasing utility.

This growth of private lines and miscellaneous services is exerting increasing pressure on the capacity of the subscriber distribution and junction cable network, and must be taken into account when forecasts of demand for cable capacity are being made. Forecasting the growth of these services is made difficult because of varied applications, wide geographical dispersion, and present high growth rates. A long term annual growth rate of 10% to 15% is not unlikely, in which case it would represent a growing proportion of the Commission's business in the future.

APPENDIX A: TELEPHONE SERVICES

In arriving at the forecasts of telephone service demand indicated in Fig. 3, a number of sub-forecasts were made of important input variables:

- a most probable population of 18.7 million people at 2000
- a decline in the number of people per dwelling from the present 3.46 to 3.00 at 2000
- a workforce to population ratio increasing from the present 0.41 to 0.50 at 2000
- an increase in the number of telephone services per dwelling from the present 0.59 to 1.10 at 2000
- an increase in the number of telephone services per worker from the present 0.14 to 0.20 at 2000

Calculations based on these assumptions result in a most likely forecast of 8.7 million telephone services at the year 2000. Consideration of likely variations to the assumed parameters results in upper and lower limits of 10.8 million and 8.0 million respectively.

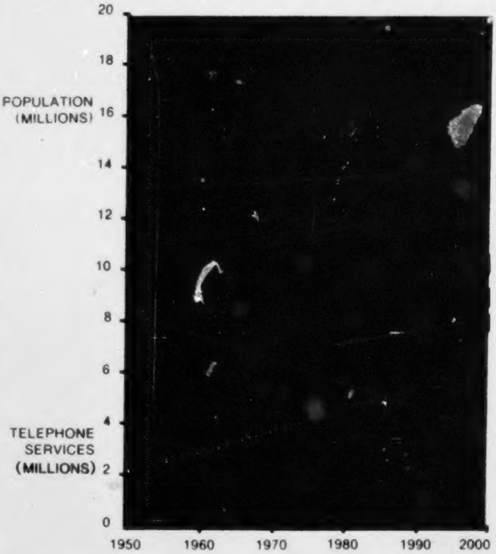


Fig. 3. Telephone services based on 18.7 million population at year 2000

Possible events supporting the higher level of demand include:

- early increase in fertility rate
- government action to sustain migration at high rates
- large scale movement of women into the workforce
- active marketing of second telephone in homes
- sustained high economic growth rate

Possible events supporting the lower level of demand include:

- low population level due to reduced migration and social concerns
- no significant change in ratio of workforce to population
- low economic growth

Based on an average capital cost of $1900 per additional service (1972/73 prices, free of overheads) rising exponentially at 2% p.a. as the network and long distance traffic expand, the range of likely demand for telephone services represents a level of capital investment between $10.8 billion and $18.5 billion, aggregated over 25 years from 1975 to 2000.

APPENDIX 8: TELEX

Development of the present CCITT standards for international telex operation has taken place over 25 years, and it is likely to be a number of years before international standards for alternative services including data and facsimile will be similarly developed. Because of the increasing importance of international operation, it is expected that the telex service, generally in its present form, will continue for many years.

Since the commencement of automatic telex operation in Australia in 1966, the annual growth rate has declined from 29% to 16%, while the number of services per 10,000 population has increased from 2 to 11. Using growth rates in overseas countries over much longer periods as a guide, continuation of these trends supports a level of demand approaching 80,000 telex services, or about 40 per 10,000 population, by 2000. This trend is shown in Curve A, Fig. 4.

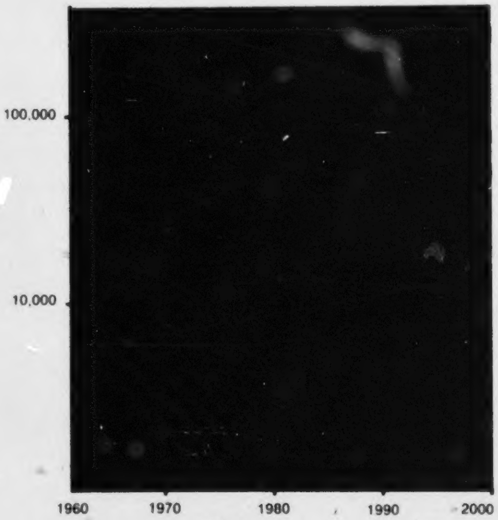


Fig. 4. Telex services

The Austdata study will produce more soundly based annual forecasts for the period to 1985, as well as providing guidelines on likely telex development up to 2000. In the meantime, however, the above estimate of demand is considered a sufficiently realistic one for discussion purposes in this paper.

However, there are a number of reasons why the level of demand could change significantly. Possible events which could result in a lower demand include:

- substitution of telex by facsimile for some applications
- more attractive tariffs for low speed, long distance data operation
- establishment of a switched data network

On the assumption that any reduction in telex demand that may occur due to these factors would be seen initially in the period 1980–1985, a credible lower limit approaching 50,000 services at 2000 is suggested, as shown by Curve B, Fig. 4. This represents a penetration at 2000 of only 25 services per 10,000 population.

On the other hand, possible events which could result in a significantly higher demand include:

- expansion to an upgraded telex network offering new facilities
- substitution of the postal service by telex for some applications
- increasing emphasis on international operation
- decentralisation of industry
- substitution of telecommunication services for transport

However, future demand may result from new applications not yet identified, swamping growth in business uses that already exist. This will be particularly so for any new applications such as telex-computer operation for education, involving the use of a terminal in the home. Using this as a basis, a credible upper limit of some 300,000 services at 2000 is suggested as shown by Curve C, Fig. 4. This represents a penetration of 160 services per 10,000 population at 2000.

Based on these two suggested limits, a variation in telex demand at the year 2000 from 50,000 to 300,000 services is possible. This represents a possible variation in the level of telex capital investment over the next 25 year period, of between some $100m and $850m (1972/73 prices). This wide range reflects uncertainty surrounding the continued long-term growth of telex, in the light of competition from new types of future data and facsimile services.

APPENDIX C: DATA

Forecasts of data services using growth over the past 2–5 years as a base will have little relevance for the year 2000. In any case, the only available statistics are in terms of data modems, which will cease to be a valid measure of data growth whenever digital data transmission techniques are implemented in the future. For these reasons, discussions of data growth in this paper have been based on the concept of data 'services' or 'connections', a statistic gaining increasing acceptance with overseas administrations. Also, the relevance of current data transmission rates in 2000 is difficult to justify, and so for the purposes of this paper, all data speeds have been grouped together.

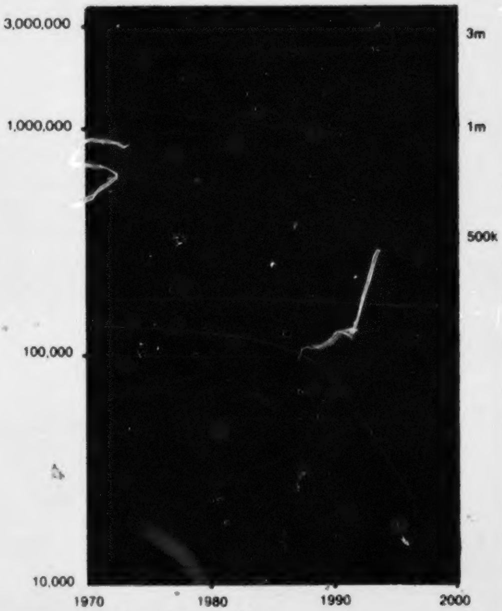


Fig. 5. Data services

The Austdata study will produce more soundly based data traffic and terminal forecasts, and will quantify the relationships between data terminal growth and the growth of computers.

In arriving at the forecast indicated in Curve A, Fig. 5, current annual growth rates of the order of 50% have been continued for the next 10 years. Thereafter, the annual growth rate has been steadily reduced and, at the year 2000, the number of data services in businesses and dwellings has been estimated at about 1 million, or about 530 per 10,000 population. This growth pattern is supported by recent studies made for overseas countries, in particular, the Eurodata study.

Again, there are a number of reasons why the level of demand could change significantly. Possible events which could result in a lower demand include:

- an increase in the use of alternative services for data transmission, particularly facsimile and telex

- an increase in 'stand-alone' processing with less dependence on telecommunications

Based on consideration of these factors, a credible lower limit of 500,000 data services by 2000 has been estimated, as shown by Curve B, Fig. 5. This figure represents about 270 services per 10,000 population.

However, there are a number of possible events which could result in a significantly higher demand for data transmission, including:

- improvements in the switched telephone network to handle higher data speeds
- proven utility of a switched data network
- early establishment of international standards for data transmission
- increasing dependence on transfer of information — e.g., cashless society
- extensive decentralisation of industry, commerce and education to remote offices or homes
- wider access to, and use of, computer based library services
- wider use of telemetering

Based on such considerations, a credible upper limit of demand, indicated in Curve C, Fig. 5, has been reached of 3 million data services at 2000, or about 1600 per 10,000 population.

Assuming reductions in equipment costs which would be likely from a move to digital operation combined with the economies of scale, it is estimated that the variation between the lower limit (500,000 services) and the upper limit (3 million services) could represent a capital investment for data transmission and switching equipment ranging from $600m to $2800m over the 25 year period. These figures assume that the cost of providing a data service will reduce dramatically over this period, and an average figure of about $1000 (excluding terminals) has been used for this discussion.

Data Terminals. At present, almost all data terminals are funded by the private sector, and for the purpose of this paper have not been included in estimates of capital expenditure for data services. Such capital requirements are difficult to estimate, considering that many of the likely applications are not known. However, the likely growth rate in data services represents a significant market for data terminals, and the Commission may need to examine its position with respect to providing terminals in some areas of application. This point is discussed further in Chapters 6 and 10.

APPENDIX D: FACSIMILE

There has been accelerating interest in facsimile services in the past few years overseas, supported by a number of studies and forecasts, which suggest that facsimile, particularly on the switched telephone network, could become a significant service in the near future.

The main criteria for public acceptance of facsimile as a preferred alternative to other communication media are cost, speed, ease of operation and equipment compatibility.

An examination of the relative costs of sending documented information by mail, courier service or facsimile shows that facsimile costs lie between those of mail and the courier service, but that advantages of speed, security, and conservation of resources lie with facsimile. For example, to send ten prepared messages, each of ten pages, a distance of 15 km across an urban centre, during the course of one week, costs:

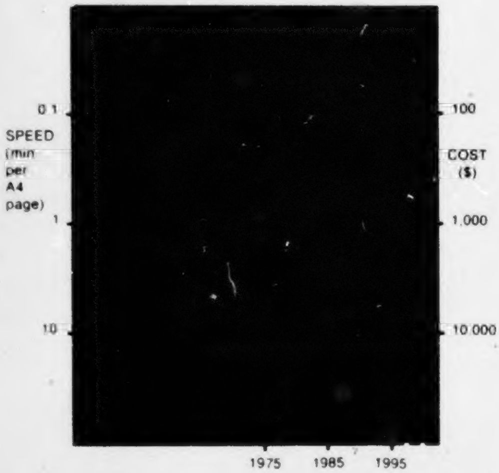
	Approximate Cost	**Delivery Time per Message**
Mail	$2.00	1-2 days
Courier service	$53.00	1 hour (minimum)
Facsimile	$16.00	10 minutes

The cost for the facsimile transmission includes call charges and terminal rental.

At the present time, the facsimile units being offered to the Commission for approval to connect to the telephone network cost approximately $2000 for a transceiver, reproduce an A4 page in 4–6 minutes and utilise a range of printing techniques which tend to be restricted in acceptability by odour, moisture, illegibility, or the need for special papers. However, present technology would support faster, cheaper designs with the investment of some research and development effort, and a speed of one minute for the transmission of an A4 page on the switched network is attainable. Transmission speeds of this order are implicit in the calculations for the exercise on document transfer costs. Machines which provide this speed of transmission are now being offered on the overseas market, albeit at 2–3 times the cost of existing facsimile devices.

The developments in speed and costs depicted in Fig. 6 constitute a forecast of the rate at which the technology could develop to support a high penetration of facsimile services. Networks with higher information capacity will support faster devices at correspondingly higher costs.

The Austdata study incorporates an in-depth investigation of the likely growth of facsimile services, based on a forecast of developments in technology as well as on market potential. Part of this study concentrates on the particular aspects of the transmission of mail by fac-



A
- ANALOGUE ENCODING AND TRANSMISSION
- WET-IMAGE PRINTING

B
- DIGITAL ENCODING
- ANALOGUE TRANSMISSION
- DRY IMAGE PRINTING

C
- DIGITAL ENCODING AND TRANSMISSION
- REDUNDANCY (SMART) CODING
- HIGH SPEED PRINTING (LASERS, SPECIAL FILM, ETC.)
- DIRECT INTERFACE WITH COMPUTERS

Fig. 6. Technology trends—facsimile

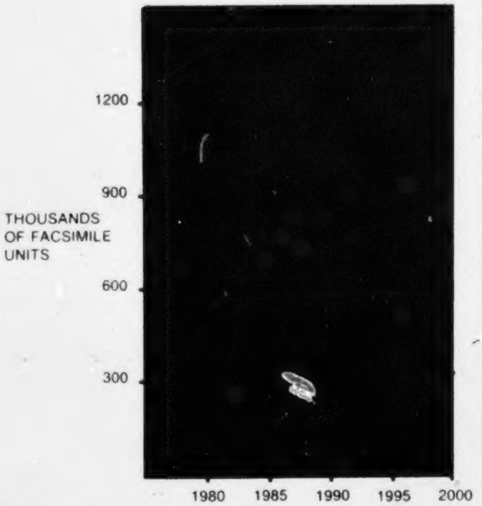


Fig. 7. Possible range of demand for facsimile units on voice grade lines

simile and gives some indication of the likely 'take-off' date for facsimile on the telephone network.

There are many reasons why the demand for facsimile services could vary significantly. Based on two different sets of assumptions, credible upper and lower limits of demand, as indicated in Fig. 7, are suggested. These limits relate to facsimile units operating on the voice grade network. Higher speed facsimile units requiring wider bandwidth circuits are not included, since the market for these units is expected to be restricted to fewer, special applications, by the complexity of operation and cost.

Possible events supporting the upper forecast limit include:

- technological developments and economies of scale, which may reduce equipment costs by an order of magnitude over the next 25 years
- an increase in the business use of facsimile, at a rate such that the proportion of business telephone services having a facsimile unit reaches 50% by 2000
- the introduction of decentralised offices, or more of the community working at home; the penetration of facsimile services into domestic, and domestic-business communication relationships may increase until, by 2000, there is about one facsimile unit for every 25 domestic telephones
- agreement on international facsimile standards
- growth of 'in-house' facsimile networks, which may create demand for inter-connection between these networks, and generate new uses and new markets

Using these assumptions, an upper limit of some 1.3 million facsimile units has been forecast. The view of a high level of demand was supported by the panelists in an NTP Delphi study, consisting mainly of most of the senior Commission executives, who stressed the increasing need for speed and accuracy of transmission, and difficulties associated with the postal service.

The lower limit forecast is supported by the following possible events:

- technological developments not proceeding sufficiently far to allow the cost of the unit to be reduced to a level which would result in an attractive tariff
- a lack of international agreement on standards leading to the incompatibility of a large number of different equipment types, restricting the ability to interconnect
- the domestic market for home-printed hard copy being catered for by other techniques, e.g. a photographic or printing unit attached to the television receiver

- the Postal Commission setting up a private line network to provide a Telemail service between postal centres

Based on these assumptions, a lower limit of some 600,000 facsimile units has been forecast for 2000.

The variation in forecasts from 600 000 to 1.3 million units represents a capital cost of between $390m and $930m based on the average cost of a facsimile terminal reducing from $2000 to $300 over the 25 year period from 1975 to 2000.

The additional network costs necessary to support a demand for facsimile on the voice grade network are minimal compared with the cost of the facsimile unit.

APPENDIX E: TELECONFERENCING

Teleconferencing refers to any conferencing which takes place between participants who are separated from each other and communicate via a telecommunication medium. A 'conference' is a meeting of two or more people with the aim of purposeful communication; that is, mutual interaction. The two main types of teleconferencing — videoconferencing and audioconferencing — offer differing but complementary facilities. A distinction exists between audioconferencing, which uses studios, and the existing, rarely used, telephone conference service. Only the former service is included in the discussion of this Appendix.

Videoconferencing, as explained in Chapter 7, utilises a wideband video link between conference rooms to enable the participants to see one another. The Commission at present operates a trial videoconference link between Melbourne and Sydney, marketed as the Confravision service.

Audioconferencing uses existing voice grade telephone lines to connect the two conference rooms and indicates which participant is speaking by operating a suitable indicator in a display panel at the opposite end.

For intra-urban, intra-state and interstate situations, teleconferencing could offer increasing savings in time, cost, fuel and energy, and greater flexibility of organisational operation in the future. These advantages could result in an increasing demand for both these services, in view of potential economies offered by telecommunications for overcoming problems of distance; possible developments in decentralisation of business operations; introduction of neighbourhood work centres and increasing pressure for energy conservation.

Many of the participants in the series of NTP Delphi studies supported the view that a significant proportion of business conferences would be conducted by teleconference means by the year 2000.

An increasing demand for videoconferencing would require the extension of the existing Confravision service initially to all other capital cities (including Canberra), and to designated growth centres and major rural cities by the 1980s. Private videoconferencing facilities, capable of being switched onto the public videoconference network as required, would further increase the demand. Extension of the service to remote areas by satellite circuits may be necessary when terrestrial circuit capacity cannot cope with demand.

The audioconference presents a budget-priced alternative to videoconferencing, and may be acceptable as a supplement to the more expensive Confravision, as well as satisfying market demands in its own right.

Present research into the dynamics of group interaction over telecommunication media is insufficient to gauge the relative utility of video and audio teleconferencing, and the extension of field research in this direction is recommended.

APPENDIX F: VIDEOTELEPHONY

Videotelephony is a switched person-to-person service which provides a real-time display of the participants in the call. Overseas experience with videotelephony has not confirmed early high hopes, for a variety of reasons discussed in Chapter 7. Despite this recent experience, it is still widely accepted that videotelephony, in some form, will eventually become a significant telecommunications service.

Fig. 8 illustrates a forecast of likely developments in videotelephony terminal technology, based on currently available reports and literature.

Generally, developments are expected which will tend to reduce videotelephone network costs by a factor of 10 over the next 20 years, through the introduction of digital transmission and optical fibre subscriber distribution, together with the economies of scale. Private videotelephone networks are expected to develop in the 1980s and interconnection of these networks may constitute an early step toward public networks.

Estimates of demand lie between two limits as indicated in Fig. 9. Possible events which may result in demand approaching the upper limit include:

- development of technological advances at the rate forecast in Fig. 8, in all the areas of transmission media, transmission techniques, terminal equipment and switching
- acceptable tariff structure
- success of field trials, and community acceptance of videotelephony as a useful telecommunication service

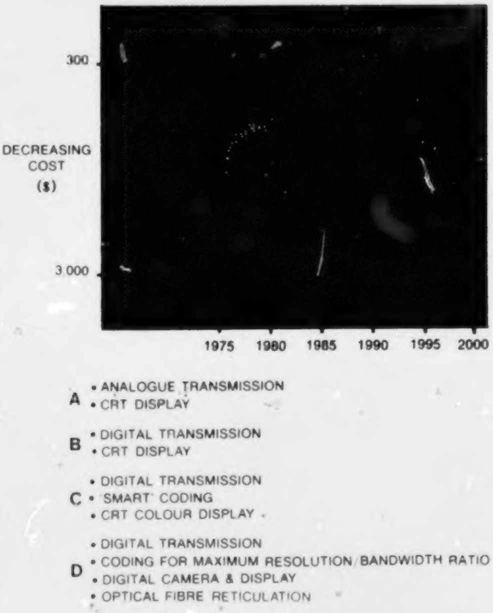


Fig. 8. Technology trends—videotelephone terminals

Based on these factors, an upper limit of 200,000 services or approximately 2% of telephone penetration at 2000 is suggested. This level is supported by forecasts arising from various local and overseas studies.

Possible events favouring a lower demand include:

- technological developments not eventuating at the required rate
- tariffs not acceptable to the user
- community preference for public booth videoconferencing
- growing evidence to support a belief that an increasing use of a video display may be both biologically and socially dangerous to the viewer
- decreasing social acceptance of video displays for communication terminals

Using these factors, a lower limit of 9000 services has been estimated.

Based on 1972/73 prices, the variation between the lower limit (9000 services) and the upper limit (200,000 services) could represent a capital investment for videotelephone services ranging from about $100m to $2000m. These figures are based on the assumption that the cost of providing the service lies in the range $8,000–$15,000, depending both on the level of demand and on the rate of technological development.

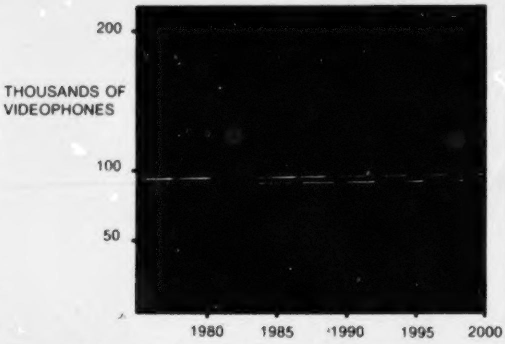


Fig. 9. Possible range of videotelephone demand

APPENDIX G: MOBILE SERVICES

Mobile services can be assumed to cover several differing types of telephony and non-telephony services as listed below:

- public mobiles connected to the public switched network, and mounted in motor vehicles
- hand-held, personal mobiles, connected to the public switched network
- despatch mobiles, not connected to the switched network, operating in distinct private networks
- facsimile, data and coded-message services

Demand for mobile services could vary significantly, and forecasts indicated in Fig. 10, have been made

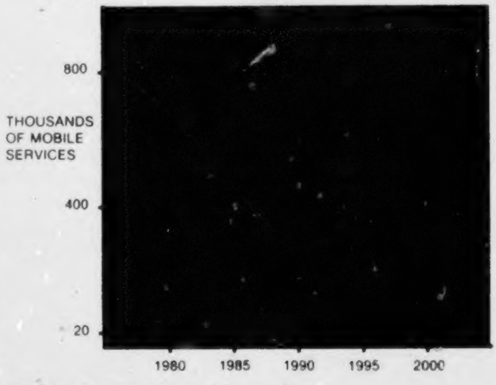


Fig. 10. Demand for mobile services

representing credible upper and lower limits of demand based on two different sets of assumptions

Possible events that could support the higher level of demand include:

- availability after 1985 of cellular mobile telephone systems with a capacity many times that of the present VHF systems
- increase in demand for low traffic despatch mobiles such as parcel delivery requiring extensive metropolitan-wide coverage
- increase in personal mobiles through the advent of digital signalling techniques, LSI and economies of scale leading to a reduction in size and cost, and improved performance of hand-held mobile telephones
- attractive tariff structures, calculated to foster market growth
- increase in vehicle mounted units capable of receiving and transmitting data with a high level of integrity
- increasing desire for personal mobility and locatability

Based on these assumptions, an upper limit forecast of some 800,000 mobile services by 2000 is suggested, representing about 10% of all telephones at that time.

Other possible events that would support a lower limit of demand include:

- technological developments not proceeding sufficiently far enough to allow the cost of the services (and hence the tariff), to be reduced to a level attractive to the user
- equipment manufacturers and leasing organisations obtaining approval to provide a large segment of the mobile market on private networks, leaving the Commission to cater for personal mobiles, hand-held and vehicle mounted, on the switched network
- society placing a low value on locatability
- spectrum shortages, and other factors, encouraging the use of paging devices as an alternative to mobile services

Based on these assumptions, a lower limit forecast of some 80,000 services at 2000 is suggested, representing about 1% of total telephones at that time.

Using 1972/73 prices, the variation between the lower limit forecast (80,000 services) and the upper limit forecast (800,000 services) could represent a capital investment ranging from $200m to $2000m over the 25 years to 2000. These figures assume that the average cost of providing the service will decrease from approximately $3500 to $2000 over the period.

Personal paging devices, although not providing mobile telephony, could be the precursor of the personal mobile. Meeting demand for paging service, at whatever level, presents little problem since this service imposes minimal demands on spectrum or capital. For this reason, no explicit forecast for paging devices has been made

APPENDIX H: CABLE TELEVISION

General prospects for cable television development in Australia are discussed in Chapter 5. Upper and lower limits to the demand for cable television are indicated in Fig. 11.

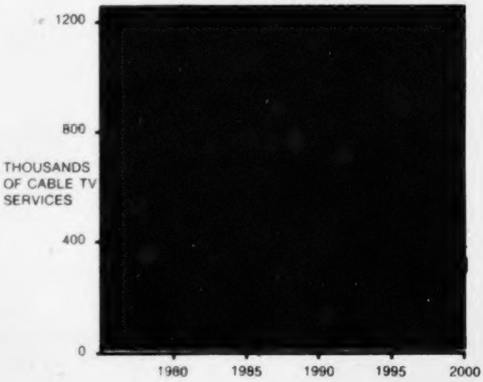


Fig. 11. Demand for cable TV services

Possible events supporting the upper level of demand include:

- availability of wide selection of programme material
- community acceptance and widespread use of public access and local government information channels
- integration of educational television into a new educational framework for continuing education
- success of pay-TV in providing first-run films, sporting events, etc.
- availability of satellite TV links to other countries for additional TV programme material

Considering these assumptions it is possible to forecast an upper limit of 1.1 million cable TV services in operation by 2000, which represents a penetration of about 16% of dwellings.

Possible events which might depress demand toward the lower level include:

- limitations of available programme material

- action by existing TV broadcasters to invoke distribution and copyright restrictions
- low community interest in public access and local government channels due to low technical standard of programming
- lack of interest by educational authorities in educational TV on cable networks
- rapidly increasing costs of programme production
- increasing concern about adverse biological and social effects of television

Based on these assumptions, a low level of demand of 260,000 cable TV services in operation by 2000 can be forecast. This figure represents a penetration of about 4% of dwellings.

At an average cost of approximately $450 per cable TV subscriber (1972/73 prices), the suggested range of demand for cable TV services represents a level of aggregated capital investment between $120m and $500m over the 25 years from 1975 to 2000. The cost of full CTV with advanced facilities is significantly greater than for a simple Community Antenna Television (CATV) service, which would fall in the $250 to $400 range.

9. INTRODUCTION OF NEW SERVICES

9.1 INTRODUCTION

From the consideration of social, operational and marketing criteria, this chapter attempts to identify those services which have the greatest potential to satisfy community needs, which can be supported by suitable development of technology, and which offer profitable returns on investment.

9.2 SOCIAL FACTORS

9.2.1 Social Accountability. With the Commission moving from being a department of state to a statutory corporation, its management has perceived an increased emphasis on business performance. However, the social responsibilities of business organisations are becoming increasingly recognised; the Australian Telecommunications Act of 1975 specifically refers to the Commission's social role. Questions of what new types of service are provided, to whom, at what rate, and with what effects, are well within the ambit of what might be considered the Commission's future social responsibilities.

Powers derived from the Telecommunications Act 1975 will enable the Commission to make future marketing decisions of a nature affecting the present range of basic services, such as telephone, telex, datel, mobile or radiopaging listed under the Act. While the Commission also has power to introduce an entirely new type of service (e.g. videotelephony), there are social arguments supporting the view that such decisions should be made, if not by an independent authority, then at least only after consideration of all points of view.

The broad objectives of the Commission do not include the pursuit of growth and development for their own sakes. Nevertheless, the satisfaction of market demand, subject to resource availability, carries the implication of continued growth for most telecommunications services, together with the development of new services. This *de facto* pursuit of growth and development, however, is not necessarily consistent with quality-of-life objectives. Organisations which merely follow the dictates of the market place may find themselves subject to government controls to protect overall community interests (e.g. the automotive industry). Alternatively, organisations may make themselves more responsive to community needs and attitudes not necessarily reflected in the market place. The Commission can help discharge its social responsibilities by establishing mediating machinery to broaden public involvement in matters which affect the community.

Possible approaches are discussed in Chapter 12, Open Planning. The establishment of national telecommunications users' representative committees could be a workable initial arrangement. These could be bodies established for the purpose, representing a broad spectrum of community and business sectors which would meet to advise the Commission of the views and likely attitudes of users. The committees could operate in a similar fashion to the Post Office Users' Council in the UK. Their advice would be a valuable contribution to the decision making process within the Commission and could support recommendations to Government if the Commission decided to refer any matter to the legislature.

9.2.2 Social Equity. At present the Commission's business is predominantly the provision of a telephone service, but this emphasis is likely to change towards the end of this century. There will be many factors pressing the Commission towards a diversification of its business into new areas such as data, facsimile and video services.

In modern society, the telephone is no longer a luxury but a necessity. As the telephone becomes more of a necessity, so those who are denied access to its attendant services are increasingly disadvantaged. Arguments based on social equity, involving a concern for equality of access, would not support the introduction of new 'luxury' services while many people are still unable to own a telephone. However, this is not to suggest that the utility of a telephone to a private individual necessarily outweighs the utility of, for example, a data service to a business enterprise.

9.2.3 Social Adaption. As discussed in Chapter 1, Social Futures, the future is likely to become increasingly complex, and characterised by increasing social turbulence. Any form of telecommunications could support either adaptive or maladaptive responses to turbulence, depending on the ways in which the service is organised and used. However, although some telecommunications services tend to support socially adaptive responses better than others, recent studies suggest that certain types of visual communications media could reinforce dissociation — the tendency for people to withdraw from direct human contact — which is a maladaptive social response.

A related concept is the value of information conveyed to different classes of people by a particular telecommunications service. 'Value of information' refers to the human uses to which information can be put by the recipient. Both of these aspects are discussed, in relation to specific services, later in this Chapter.

9.3 OPERATIONAL FACTORS

9.3.1 General. As well as the state of technology and expected market demand, various operational factors will influence decisions as to whether new services should be introduced. These factors include resource availability, financial viability, staff nurturance, exploitation of existing assets and entrepreneurial risk-taking.

- Resource availability includes the capacity to generate and borrow capital funds as well as the availability of trained staff. Changes in staff levels have to be gradual and take into account the time-lags of training programmes. That is, the introduction of new services will have to be well-planned over a number of years to achieve a smooth transition which does not strain resources.
- Financial viability is discussed further in Chapter 10. Factors to be considered include an assessment of the ability of present services to maintain an adequate level of profitability and the positive or negative effect of the introduction of new services on this profitability in both the short and long-terms.
- Staff nurturance concerns the need to motivate highly trained staff with challenging work, and the need to attract and develop high quality staff to meet the Commission's long-term needs. These will depend, in part, on the Commission's attitude to innovation.
- Exploitation of existing assets implies the strategic marketing of services which tend to increase the utilisation of the existing network. The telephone network can be used in the development of some services; other services can make use of parts of the telephone network. In the extreme, completely new networks might be required for some services. There will be strong economic reasons favouring those services which require least additional plant for their realisation, particularly if the entrepreneurial risk in establishing the service is high. There is also a social equity argument: a service utilising the telephone network can facilitate equality of access much more rapidly than one which requires the establishment of a new network.
- Entrepreneurial risk-taking concerns the extent to which the Commission chooses to explore market opportunities rather than to follow trends apparent overseas. All new services arise from the willingness of telecommunications administrations, somewhere in the world, to take risks. It may prove dangerous for the Commission to fall into a permanent stance of following overseas leads. This can carry long-term penalties at a national level, and also exposes the Commission to the risk of losing its telecommunications monopoly. For example, the Commission could miss opportunities in the field of CTV, if it showed a consistent reluctance to accept risks which private entrepreneurs were willing to take. (This, of course, could prove to be either good or bad fortune, depending on the viability of CTV in Australia.)

A useful compromise might be the sharing of the entrepreneurial risks associated with ventures into new services, between the Commission and the telecommunications industry.

9.3.2 Technology and Costs. At any time, proposed new services could be provided by existing technology at certain costs. For each service there will also be a prognosis of the likely technological improvements and attendant cost reductions in the coming years. The choice of one service over another will depend heavily on the expert assessment of these factors. As an example, a switched videotelephone service depends on the adoption of a national (and possibly international) standard. However, the premature adoption of a standard could 'lock-out' further significant developments of video technology. Thus the adoption of a video standard must take its timing from the development of relevant technology; other services, less dependent on establishing standards, might well take precedence. Similarly, the introduction of some service might be deferred if significant cost reductions, which would affect the market demand, were expected in the future.

9.3.3 Monitoring. A formal information monitoring system would enable the Commission to obtain information from the total environment about likely technological, economic and social changes. This would greatly assist in assessing markets for new services, the possible demands within these markets, developments in the technology, and the cost structure of new services.

Monitoring of the environment will be most effective if groups within the Commission are given explicit responsibility for gathering, analysing and disseminating this information.

9.3.4 Field Research. Field research is discussed in Chapter 11. One of the purposes of field research is to gain information about the likely demand for different services, and to assist in the marketing of services which are to be pursued. The importance of field research as a pre-requisite to the introduction of new services is emphasised.

9.4 MARKETING STANCE

9.4.1 Market Segments. In marketing there is an underlying dichotomy between universal and particular goals. A universalist approach (the same telephone service for everybody) follows logically from the pursuit of cost-effectiveness or social equity. However, peoples' needs differ, and every effort should be made to match particular needs. For example, the advent of stored program controlled exchanges will lead to the possibility of a wide range of subscriber options which could be marketed to enlarge subscriber choices.

Any particular service can be marketed in different ways. Each service can be physically tailored for one or more segments of the total market, and the introductory marketing directed at the target segments. For example, the table below sets out conventional ways of classifying market segments for individual or social units. While not all segments can be supplied initially, the social consequences of marketing decisions need to be studied and appreciated, since the choice of target segments implies a deprivation of other segments of the market.

- Characteristic Differences
  - Socio/Economic
    - Income
    - Occupation or Social Class
    - Education
  - Demographic
    - Family Size
    - Sex
    - Age Distributions
  - Geographic
    - Country
    - Region
    - City
  - Psychological
    - Personality Types
    - Price Consciousness
- Response Differences
  - Perceptual Factors
    - Perceived Benefits
    - Brand Awareness
  - Usage Factors
    - Product Usage
    - Brand Loyalty
    - Media Habits

The Commission has traditionally been concerned with two basic market segmentations: business-private and country-metropolitan. Future marketing in the Commission may have to take increased account of other socio-economic groupings within these broad segments. Markets for services can also be segmented into individual or collective groupings and traditionally we have tended to serve the needs of individuals or individual organisations — although the public telephone is an important example of an existing, collective service. There may be significant new markets for future shared or collective services, both in business and the community, such as extension of the present pilot confravision service, and the establishment of community telecommunications centres for both business and recreational purposes.

9.4.2 Tariff Strategy. Tariff strategies for the introduction of new services include:

- high introductory tariffs to maximise profit and restrict growth
- low introductory tariffs to encourage growth
- tariffs based on the ability of different market segments to pay

Combinations of all these are possible, for different services in different circumstances.

Other tariff strategies include the ownership or leasing of terminals, and maintenance contracts versus service payments for the maintenance of terminal equipment. Approaches to tariff settings are discussed further in Chapter 10.

It is important to appreciate that the success of many new services will depend on the co-operation of third-party entrepreneurs. Computer-aided education, remote shopping or banking and remote meter-reading are examples. It will not be enough for the Commission to sit back secure in the knowledge that we can supply the circuits when the entrepreneur wants them. If such services are to evolve, the Commission may have to take a more innovative role and also be prepared to adopt a flexible approach to the marketing and pricing of its services at the introductory stages, depending on the proposed use and the likely volume of demand.

9.5 APPROACH TO SELECTION OF NEW SERVICES

9.5.1 General. An attempt is made in this section to develop and apply a set of decision-making criteria to particular classes of potential services. The services considered are: CATV, CTV, facsimile, new data services, video and audio conferencing, person-to-person video, and mobile radio-telephone. The results of considering each service are summarised against a range of social criteria (table 1) and technical and marketing criteria (table 2). The particular gradings given each service are very value laden and depend on the definition of terms. The presentation is not intended to be definitive, but as an introduction to further discussion.

The discussion which follows is intended to define the particular criteria used in the tabulation, and to explain briefly why particular services were given their respective gradings against each criterion.

9.5.2 Social Assessment. As well as considerations of social equity and adaption, mentioned earlier, social assessment of any new service should include an examination of its associated cultural values. Also important are the inherent social properties of the particular medium itself (audio, video, print or graphics) — its intrinsic effectiveness in human communication, its physiological and stimulus characteristics. (Data services have not been graded because the variety of form which these may take prevent generalisations.)

						Video		
Criteria	**CATV (Video)**	**CTV (Video)**	**Facsimile (Print and Graphics)**	**Data**	**Mobile Telephony (Radio)**	**Conference**	**Person to Person**	**Audio Conference**
Relevant cultural values	Growth Privacy Equality Security Humanisation Freedom Beauty	Growth Privacy Equality Security Humanisation Freedom Beauty	Growth Privacy Security	Growth Privacy Equality Security Humanisation Freedom	Growth Privacy Equality Security Freedom	Growth Security Humanisation	Growth Privacy Equality Security Humanisation Freedom	Growth Equality Security
Knowledge about	low	low	high	—	medium	low	low	medium
Knowledge of	high	high	medium — high	—	high	high	high	high
Identification knowledge	high	high	medium	—	medium	high	high	medium
Possible physiological effects	high	high	low	—	low	high	high	low
Stimulus properties	passive	passive	active	—	active	passive	passive	active

Table 1 — Evaluation of social factors

It is also re-emphasised that the overall social implications of any new service depend to a great degree on the manner in which the new service is itself introduced and organised — this in turn will be strongly influenced by the organisation and the structure of the Commission itself.

Cultural Values

The new services under discussion will have varying implications for our values about growth, privacy, equality, security, humanisation, freedom and beauty, at least. People with strongly held values, either positive or negative, about growth or privacy can be expected to exert continuing and increasing pressure for or against the introduction of new services. In addition specific services (e.g. CATV, CTV, data and mobile telephone) would appear to be especially relevant to questions of equality of access and of resource distribution. Video displayed services are likely to produce pressure from those who are concerned with questions of humanisation and freedom. (In the case of freedom, shared use facilities, such as videoconference, are likely to lessen the problem.) Lastly, most services have implications for peoples' values about security — both personal and organisational — since all sophisticated telecommunications systems can be seen as threatening personal and organisational security.

Ability to Transmit Understanding

For the purpose of this discussion *'understanding'* is defined as:

- the ability to communicate knowledge *about* something (i.e., analytic, conceptual knowledge). Knowledge 'about' is crucial for reliable decision making
- knowledge *of* something (i.e., does 'it' exist at all, regardless of context)
- *'identification'* knowledge of something (i.e., how would it feel to own 'it', or if 'it' was part of me)

Video-screen presentation, by an iconic or structural image, is useful for communicating knowledge 'of' events. It also has a high ability to communicate 'identification' knowledge — what it might feel like to be involved in the event (hence the attractiveness of entertainment through video-screen presentation). There is some evidence, though inconclusive, that any distributed video-system has intrinsic barriers against transmitting knowledge 'about' something, due to factors operating at the neurophysiological, psychological and social levels.

The facsimile transmission of print and graphics combines the credibility of a picture with the analytic properties of print to produce a high relative value as an information transmission medium. Facsimile services would appear to have a high potential to communicate understanding.

Possible Physiological Effects

This criterion relates to the possibility that certain media for services may have unforeseen biological implications. Some recent research suggests possible long-term neurophysiological disturbances as a result of television screen viewing. If this were validated, then the Commission's involvement in the further provision of distributed video services would need to be seriously questioned.

Our long-term physiological functioning does not appear, at present, to be affected by any other media — except where their use reinforces a general lack of physical activity. However, the possible long-term effects of different media on eyesight, etc., should be carefully monitored.

Stimulus Properties

An important issue is the extent to which the stimulus properties of the medium itself affect a service's capacity to produce directed action in the recipient. In the case of video-screen presentation, the mosaic character of the visual stimulus, may encourage passive rather than directed behaviour. Improvement in the quality of the screen image from the repeated mosaic display of present video-screens towards movie-grade display is a development which could be tested directly for its social implications. An answer to the question of the effects of mosaic images is relevant to decisions about the marketing of video-based systems.

The services whose stimulus patterns appear to be most consistent with the production of directed behaviour are facsimile transmission and mobile telephony. In the case of facsimile, the written text is associated with direction and the consideration of available alternatives. Mobile telephony is necessarily involved with movement to and from points associated with action. The combination of facsimile transmission and audioconferencing could be equally conducive to purposeful activity.

9.5.3 Technical and Marketing Factors

Initial Network Investment

CATV and cable TV require a single coaxial cable reticulation and minimal distribution hardware, whereas videotelephony requires discrete wideband reticulation and complex switching. Moreover, CATV and cable TV reticulation can be provided in limited geographic areas, while videotelephony requires a more widespread initial network. Services like facsimile and medium speed data, to the extent that they exploit the capability of present

			Facsimile		**Data**		**Video**			
Criteria	**CATV**	**CTV**	**Business**	**Domestic**	**Business**	**Domestic**	**Conference**	**Person to Person**	**Mobile Telephone**	**Audio Conference**
Resources of Telecom Australia:										
Initial network investment	low	low	nil	nil	medium	v. low	medium	v. high	medium	v. low
Terminal investment	v. low	low	high	high	—	—	high	high	high	medium
Manpower / training	high	v. high	low	low	medium	medium	v. high	v. high	high	low
Marketing:										
Potential markets	medium	medium	v. high	v. high	v. high	v. high	high	—	high	high
Confidence in early demand	hign	low	medium	low	high	low	medium	low	high	high
Profitability	low	medium	v. high	medium	high	medium	medium	—	v. high	high
Technology:										
Availability	mid 70s	late 70s	mid 70s	late 70s	mid 70s	mid 70s	late 70s	mid 80s	late 70s	mid 70s
Potential cost reduction	v. high	—	v. high	v. high	v. high	v. high	v. high	v. high	v. high	medium
Dependence on software	low	v. high	—	—	medium	high	—	—	—	—

Table 2 — Evaluation of technical and marketing factors

networks, would require minimum new investment, although new data networks for business applications would involve significant outlays.

Terminal Investment

There are several approaches to the supply and ownership of terminal equipment for each of these services but this evaluation assumes some Commission investment: The exceptions are data and CATV, where the terminal devices are expected to be provided by the user. Additional termination equipment for response capability would be required for cable TV.

Manpower-Training

In comparison with services which utilise the present network and existing expertise, those which involve new networks and devices will require an increased investment in manpower resources. Services which transmit and display a range of video images or high speed data require considerably more technical expertise than narrower bandwidth services.

Potential Markets

For CATV and cable TV, the assessment is based on an over-riding demand for entertainment TV. The potential market for videotelephony is uncertain, and requires further examination, for example, field research of concepts. The demand for audioconferencing and videoconferencing may provide an indication of the acceptance of group-group communication as an aid to business efficiency, and eventually of the demand for switched video services.

Confidence in Early Demand

A significant early demand for each service is an important factor, irrespective of the forecasts for potential markets. For example, business use of data services is considered a growth area at present, but future penetration of domestic dwellings will probably increase with the availability of suitable data banks, information services, etc. Confidence in a high early demand for CATV contrasts with a lower confidence in the demand for the augmented services of cable TV.

Profitability

This criterion refers to the likelihood of each service being profitable within the constraints of tariffs and demand. Those services which utilise existing plant are considered likely to be the most profitable, whilst videotelephone operations, for example, will require considerable further social and technical investigation. This assessment of profitability is made in the context of the Commission choosing to supply the necessary terminal equipment for services other than data, and to establish both audio and video conferencing networks.

Availability of Technology

Although present technology will support all of these services, various degrees of development are required in each case before a reasonable penetration of service could be sustained. CATV technology is well established, cable TV is still developing, and facsimile terminals are becoming faster and easier to use. Data services are presently available and rapidly proliferating, but developments of videoconferencing, studio audioconferencing, advanced mobile services, and videotelephony have not yet passed the experimental stages; lack of agreement to standards of operation nationally and internationally may retard development.

Technology Potential and Cost Reduction

Potential technological developments open up the prospect of considerable reductions in the cost of providing many services. Terminal devices may, for example, adopt large scale integration and digital techniques. Transmission media such as optical fibres would significantly reduce the reticulation costs for video services. Terminal costs for audioconferencing are relatively low. The emphasis will be on the future reduction of network costs for all services.

Dependence on Software

The marketability and viability of those services which provide access to information stores and data banks will depend on the amount, and hence cost, of the supporting software included in those stores, banks, etc. This category does not include the software associated with switching and transmission functions, which may, for example, be considerable in new mobile radio systems utilising cellular techniques.

9.6 CONCLUSIONS

Whilst expanding existing services and developing new services, the Commission has to be aware of community needs and attitudes, some of which are not necessarily reflected in the marketplace. Similarly, market and social forces are promoting rapid developments in all facets of telecommunication technology, with the consequent rapid rise of new markets for communication services and changes in established markets.

The recommendations which follow provide a timetable for the orderly introduction of each service, and a basis for the necessary planning and marketing studies. These recommendations recognise the state of present technology and the ability of the Commission to offer the service. No attempt has been made to suggest implementation or market strategies for those services such as videotelephony whose development is seen to be well into the future. The relatively high ratings of a facsimile service in the social, technical and marketing areas suggests the considerable potential of facsimile as an early service.

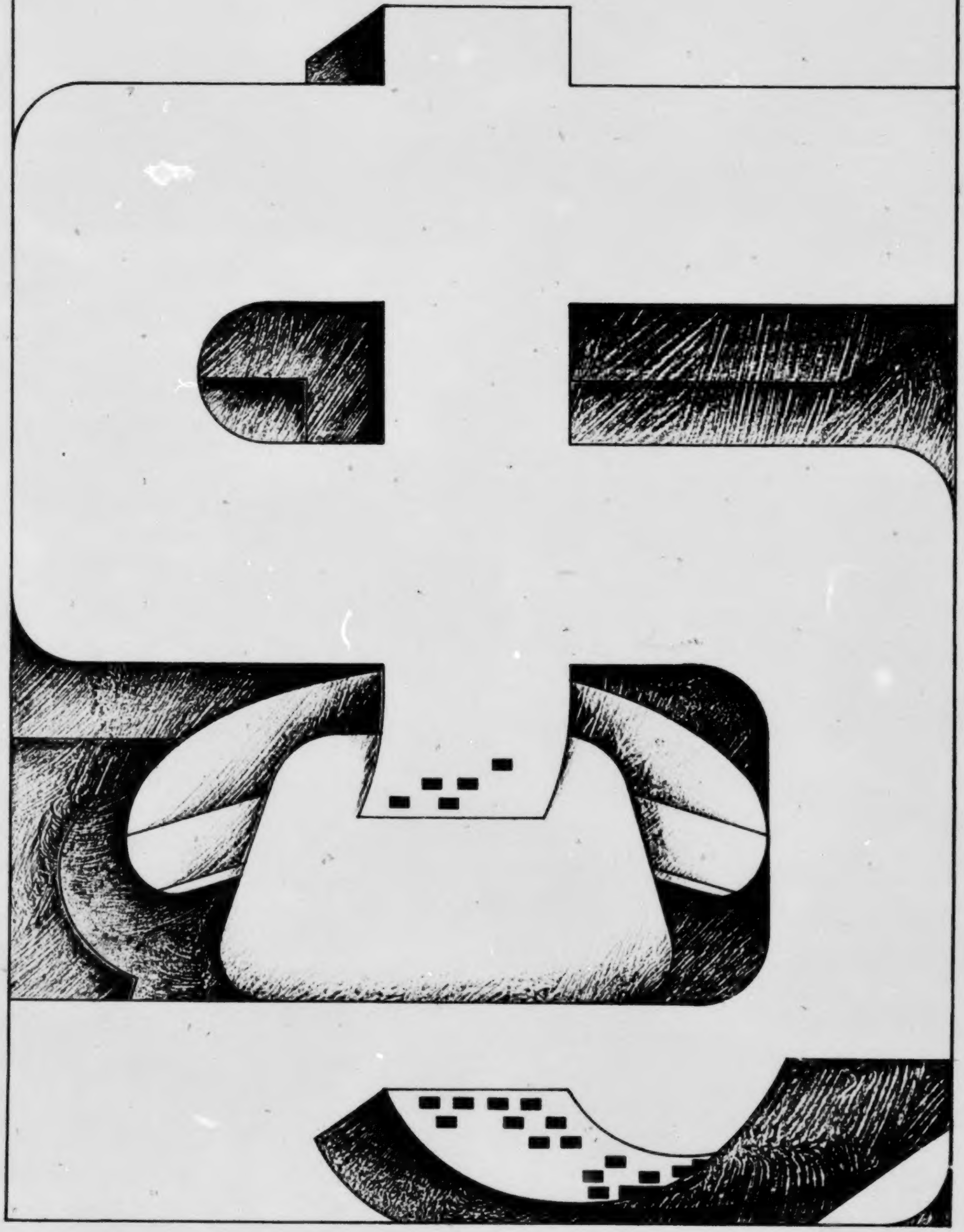
The initial growth in facsimile services is expected to be based mainly on 'in-house' use within organisations. However, this initial growth will be followed by a demand for inter-connection between services utilising the switched network, and accelerated by an emerging demand for telemail and like services. The lack of operational standards for facsimile is expected to inhibit rapid network growth initially. Technological developments which may increase operational speed, simplify use and reduce terminal costs are forecast within the next five years. The strategy for the introduction of facsimile depends on the Commission making known its intention to market a switched facsimile service, operating on the switched network, as soon as such a service becomes practicable, and taking steps to establish operational standards.

RECOMMENDATIONS

It is recommended that:

1. The Commission promote establishment of mediating bodies (for example, user representative committees, etc.) to broaden public involvement in telecommunications matters which may affect the community.
2. The Commission strengthen existing machinery to monitor and study the interaction of social and economic environments with telecommunications and to make the information generally available.
3. (i) The Commission actively consider marketing a facsimile service in competition with present suppliers, offering network interconnection with directory listing to Commission-supplied terminals.
   (ii) The Commission further investigate developments in the technology with a view to obtaining, as soon as possible, a supply of suitable terminals capable of, for example, transmission of an A4 page in 30 seconds. A research and development contract with an Australian manufacturer to develop a suitable device locally, should be considered as one possible way of proceeding.
   (iii) Following the results of (ii) the Commission take positive steps to establish local standards for facsimile, and co-operate with the CCITT to have these standards accepted.
4. (i) The Commission evaluate the market for new audio/visual information services which exploit the existing telecommunications network facilities.
   (ii) The Commission seek the co-operation of third parties to provide information content and software support for these services.

10. ECONOMIC VIABILITY AND TARIFFS



10.1 INTRODUCTION

Previous chapters have outlined the expected growth and development of existing and new telecommunications services between now and the year 2000. Estimates have been made of the likely cost of these services and the ranges of possible demand for them. This chapter attempts to answer the questions:

- whether the Commission will be able to support and service the level of capital expenditure needed to provide these services
- whether individual users will be able to afford the charges that would have to be made, consistent with a level of demand at which the services become viable; this will depend on income levels and distribution, and the proportion of income that people would be prepared to spend on these services
- what principles should guide the Commission in its approach to fixing of tariffs

The broader question, whether the nation as a whole can afford to devote the necessary share of Gross Domestic Product and in particular of Gross Fixed Capital Expenditure to the telecommunications sector, was discussed in Chapter 2. It was concluded that the level of funds required would be within practicable limits.

10.2 CAPITAL INVESTMENT AND RETURN ON FUNDS EMPLOYED

It is expected that if the annual telecommunications expenditure by year 2000 has reached the intermediate level within the possible range previously outlined, cumulative capital expenditure for the twenty-five years will have amounted to about $21,000m (in 1973 prices). Given that the necessary capital is available nationally as expected, it will be the responsibility of the Commission to ensure its ability to make the requisite contribution to capital needs.

Appendix 1 to this chapter is a graph representing the likely trend in annual investment by the Commission over this period. It illustrates the expectation that provision of newer type services as distinct from the basic telephone service will collectively become an increasingly significant component of Commission activities in future. This will have an important influence on the financial viability of the Commission.

The current financial objective set by the Commission of Inquiry for the telecommunications authority requires that 50% of all its capital needs should be internally generated by the business operations of the authority. This represents a more stringent requirement than the authority operated under in the past. Over the last 5 years the telecommunications service has financed from its own internal resources 43% of its capital requirements. Telecommunications services in 1973/74 yielded a return of about 8% before interest, or 2.1% after interest. To maintain the financial objective now imposed, a higher overall rate of return on assets employed (and a depreciation policy which accounts for inflation) will be required in future.

Tariff policies will need to be reviewed if the Commission's financial objective is to be attained, but there is a practical limit to which it would be possible to rely on the telephone service as the dominant contributor to long-term profitability. Basic telephone rental and call charges are in general politically sensitive, and additionally, social trends are in the direction of placing the telephone in the category of a social necessity. For this reason, the Commission in seeking to maintain financial viability, will need to depend much more on the newer types of services.

The future rate of return on new and developing services is difficult to estimate, but experience to date with those which have already been established (in particular telex and data services) supports the expectation of higher profitability. These services do of course benefit on the cost side from operating in conjunction with the existing telephone network. For services of the type envisaged, a return of 15% on capital (after interest) is considered to be practicable. Should future investment follow the trend suggested in Appendix 1, it seems likely that the 'other' services will be making a major contribution to profit towards the end of the century. The graph in Appendix 2 shows the estimated growth in annual profits of the two sectors if, for instance, the telephone services were to achieve a 5% p.a. return on assets and the other services 15% p.a. These are hypothetical rates and are not intended as a suggested target or prediction. Furthermore, they presuppose that the depreciation charges are based on historical costs only.

10.3 DEMAND FOR SERVICES AND SUBSCRIBERS' CAPACITY TO PAY FOR THEM

There is an essential circularity between the cost of providing services, the resultant price at which they must be marketed to recover costs, and the levels of effective demand at that price. It is not easy to determine in advance at what level of provision an appropriate equilibrium is likely to be reached, and this introduces planning problems. However, provided unit costs are fairly constant over a substantial range of output, some arbitrary estimate of the initial practicable level of provision can be made, and average costs estimated on that basis. This approach has been used here. Demand will of course be limited by the ability of would-be subscribers to pay for the services and, in assessing their capacity to pay, it is essential to take account of the distinction between various categories of customers, e.g. those requiring services for business purposes as distinct from those wanting them for use in the home.

10.3.1 Business Demand. Business demand will usually not be constrained by capacity to pay in the same sense as that of the householder. Generally speaking, business demand will exist so long as the service is able to generate an income or effect a saving which exceeds the cost of the service. Business demand for services already available, particularly telex and data, is in excess of current capacity to provide them. The trends towards cheaper tariffs (in real terms) for these services should further stimulate demand. Telephone and other telecommunications service charges do not represent a major cost component for most businesses, and their capacity to pay is unlikely to be an inhibiting factor up to the level of demand postulated for them.

10.3.2 Household Demand. For the typical householder, however, the chance of achieving the corresponding level of increased income or cost saving, while still possible, is less likely. People's decisions to subscribe to new services will also be influenced by psychological factors. Capacity to pay may therefore not necessarily correspond with willingness to pay. The latter is defined as people's perceived need for a service relative to other goods or services they could purchase.

Some unresolved problems in assessing people's willingness to pay for new services include:

User Familiarity. At present experts can guess at only a fraction of the uses to which new services will eventually be put. More will be discovered during field experiments and the early stages of marketing. Potential users of a new service may be deterred by its apparent complexity and be unfamiliar with its ultimate possibilities. The rate of discovery and proliferation of knowledge about new uses will be crucial for determining the timing and rapidity of the 'take-off' in household demand.

Interdependency of Demands. Both complementarity and substitution relations can be expected to influence demand for the various types of services expected to become available in the future. Only some of these relationships are foreseeable at present.

Competing Products. There will be many other new goods and services which may compete with new telecommunications services, and in addition, if telecommunications services are made available for use on a community basis, household demand is bound to be affected.

Market Segmentation. Knowledge about the size and characteristics of relevant market segments is not yet available. It is not possible to pin-point which classes of households might be significant users, or those groups whose acceptance of a new service will pressure others to connect because of social dependency or 'taste leadership'. Current commissioned studies on telephone usage are nearing completion, and the results are expected to provide valuable information on potential household demand for new telecommunications services.

The increasing penetration of the ordinary telephone into the domestic market is evidence of a greater willingness and capacity to pay for telecommunications services. Supporting evidence of an increasing level of 'affluence' supporting this growing demand may be seen in the proliferation of, for example, second cars and other consumer durables. At the same time, telecommunications services are becoming relatively cheaper in terms of average weekly earnings. Between 1964 and 1975 trunk call charges as a proportion of average weekly earnings decreased by about 50% on average, while the corresponding decrease for domestic telephone rentals was about 22%.

Recent studies (see Appendix 3) have shown that approximately 60% of dwellings have a telephone service. The penetration among lower income groups is relatively high—e.g. in 1974, 56% of households with incomes below $6000 per year were connected. This can probably be accounted for by the fact that pensioners are entitled to a subsidy of 33% of the rental cost of the service. There are at present over 500,000 pensioner concessions in force, representing nearly 25% of all household telephone services. However, even where the concession is not available, a domestic service appears to be within the financial capacity of most households. A departmental study conducted in August 1974 showed that the average yearly cost to a household for its telephone was about $120, or $2.30 per week, at which time average weekly earnings were in the region of $140 per week. Expenditure of the average household for its telephone service has been calculated to represent no more than about 3% of the median household income in 1974, and the proportion is expected to decrease in time as real incomes rise with gains in productivity. Further, it seems likely that subsidies of the pensioner concession type will eventually be extended to other disadvantaged groups who would otherwise be unable to subscribe. From all the available evidence it seems reasonable to expect that, by the end of the century, practically all households will have a telephone.

Any firm conclusion as to the future domestic demand for telecommunications services other than the telephone is of course difficult. In approaching the question of a household's capacity to pay for these, it would be desirable to compare the tariff for the new service with estimates of household incomes. Naturally, however, the likely future levels of tariffs remain nebulous at this time, although some indication may be gained from the estimated capital cost per service.

The trend in average capital cost per service (exclusive of administrative overheads) over the next 25 years for each of these services has been estimated (in 1972/73 prices) at:

Data (network only)	$5,000 reducing to $500*
Telex	$3,000
Facsimile (terminals only)	$2,000 reducing to $300
Mobile	$3,500 reducing to $2,000
Videophone	$15,000 reducing to $10,000 (low demand) or $5,000 (high demand)

**This figure is the average of all data services, many of which can be provided at minimal cost on the switched telephone network.*

The estimated provision cost referred to above is an average for all possible types of services, both business and private, and would usually exceed the cost of providing a typical household service. A business terminal might, for instance, be a high quality unit, costing several thousand dollars whereas a household terminal could, and probably would, be relatively quite cheap.

Some typical household applications may consist of:

- a video display using the ordinary domestic television receiver to display data relayed over the telephone network together with an interface device worth perhaps $50 to $100
- a push-button facility for data signalling incorporated in an otherwise standard telephone instrument
- a light duty facsimile terminal, conceivably priced as low as, say, $200 to $300

Apart from the few cases where a household opts for a videophone, the cost to the subscriber for a service additional to a telephone need not be great if the suggested decrease (in real terms) in the present-day costs of data and facsimile terminals is realised. Terminals would represent the principal cost if used in conjunction with the normal subscriber's telephone line. This would usually be so in the case of household services, and the annual rental charge for such a service would depend largely on the expected working life of the terminal. If we suppose the average household terminal to cost $200 to $300 as suggested above, the annual rental need not represent more than a marginal addition to the cost of the telephone service which provides the network into which the data or facsimile services would work.

The householder may usually regard telex, data and facsimile services as alternatives, chosen perhaps according to individual needs. Demand assumptions formulated in a previous chapter, though necessarily tentative, suggest that by the year 2000 most households would still have a telephone only, but at least 10% would have one of the other services as well. The households would typically be those enjoying a higher than average income and as an indication of the feasibility of the estimated demand, it is relevant to consider the distribution of incomes among households. Only one detailed study of this kind purporting to cover the full range of households has been conducted in Australia. This was a survey of household incomes and expenditures for the year 1967/68 and the relevant table of results is shown in Appendix 4. From this table, it may be estimated that the top 10% of households had incomes of more than twice average weekly earnings and the upper quartile (25%) would have incomes at least 50% higher. This would suggest that estimates of demand for future domestic telecommunications services are within the bounds of the likely ability of households to support them. In addition, it has been estimated that between 1967/68 and the end of the century real per capita incomes will approximately double.

10.4 TARIFF POLICIES

10.4.1 Economic Theory of Pricing. Prices determined for a particular industry have an economic significance extending beyond that industry. The price at which a product or service is sold will influence the level of demand for that product, and this in turn will influence the allocation of resources as between industries. Some economists assert that if prices are set equal to marginal cost in all industries, a socially optimal allocation of resources will result. This follows, it is argued, since the opportunity cost to the consumer of purchasing the last unit of output will tend to be equated with its cost of production.

While the theory helps in understanding the issues involved, there are many obstacles to its application as a means of achieving the end object of maximum social welfare. A major objection is that, whether short-run or long-run marginal costs are used (and economists are not all in agreement on which is more appropriate), it does not automatically ensure that total revenue will be sufficient to meet total costs. For example, where average costs would continue to decline over the full relevant range of output, marginal cost would at all times be below average cost, so that a marginal cost pricing policy could in these circumstances produce a deficit. The telecommunications service would probably be in this position of decreasing unit costs for most of its services. In practice, therefore, the Commission would need to relate its tariffs to average costs, which incidentally are more readily determinable than marginal costs. In any case, marginal and average costs tend to converge in the sufficiently long term.

10.4.2 The Background to Telecommunications Tariffs. Since 1959, following recommendations of a Committee of Inquiry into its financial operations, the telecommunications authority has been required to operate profitably as a business enterprise and to pay interest on funds advanced by the Treasury. However, it has not been free to fix charges for its services without Ministerial or Parliamentary approval, and, as a consequence, political considerations have tended to inhibit the development of a consistent philosophy or policy on tariffs. As far as the standard telephone service is concerned, tariff increases, when they were imposed, usually served the dual purpose of maintaining profitability and restraining demand for new services within manageable limits. Sometimes the limits have been determined by lack of capital funds and sometimes by shortages of manpower or materials.

The effect of political and social factors has been important in influencing the level of some charges, with the rates applied being at times in direct conflict with the incidence of cost. Country telephone services, which normally are relatively costly to install, traditionally carried a lower rental. More recent evidence of political intervention has been the removal of concessions for some country services and the reintroduction of a differential rental between business and residence services.

With the passage of time, some wide disparities have developed in levels of profitability as between the various services offered. Some of these disparities will no doubt be retained for social or political reasons. The adverse effect on profitability tends to increase with time as the low tariff stimulates a greater demand which often has to be met at the expense of profitable services. It is essential that the cost in terms of profit foregone can be adequately assessed. Product costing will therefore become increasingly important as the expanding range of future new services is introduced.

10.4.3 Future Tariff Approaches. The long-term financial viability of the telecommunications service requires that whatever the approach to individual tariff charges may be, overall profitability must be maintained. Within this framework, differences in profitability of individual services will probably continue as at present, some being more influenced than others by consideration of 'what the market will bear', e.g. trunk telephone traffic and data and telex services.

Future developments will, however, tend to change cost patterns and these will no doubt influence tariffs in the longer-term. We can expect, for instance, the falling level of transmission costs to continue. They will also become less distance-dependent; this will be further accentuated if domestic satellites are established. Thus, the profitability gap between local and long distance traffic charges will continue to widen unless there is a change in tariff relativities. Local network and switching costs, on the other hand, will probably not fall so significantly although optical fibre should in time make a greater bandwidth available at relatively low cost.

Traffic patterns may also be substantially changed with introduction of new services. For example, switched-network data services may be expected to generate many long-duration local calls and this will give added urgency to the need to introduce timing of local calls.

10.4.4 Terminal Provision. A feature of many new services will be the high proportion of capital cost involved in terminal equipment. Policies adopted for terminal provision will have an important bearing on the Commission's profitability. Three broad options are available:

- to lease them to the customer
- to buy them and sell them to the customer
- to permit the customer to buy his own terminal

With each of these alternatives the Commission may further opt to install and/or maintain the terminals, or leave that to the customer to arrange with its equipment supplier.

No single policy is likely to be applicable to all situations or types of equipment. Customers will range from major companies to domestic subscribers, and equipment types will vary from highly sophisticated computer equipment to relatively simple devices like a push-button telephone key-pad.

In any particular situation relevant financial considerations will include:

Whether capital is available. If there are sufficient funds the Commission could probably improve its earning capacity by leasing rather than permitting ownership to pass to the customer. Should funds be scarce however, it might be difficult to justify curtailing network provision while at the same time restricting customer participation.

The cost of maintaining equipment. It may prove to be costly and difficult to provide a maintenance service if, as seems likely, the terminals are increasing in variety and growing in complexity, e.g. training of staff could be a major problem.

The effective life of terminals. The life of this type of equipment can be quite short through obsolescence due to technological change, and customers who lease terminals could press for more modern equipment when this happens. This could prove costly to the Commission.

Leasing of terminals is on the whole likely to prove a profitable area of investment. Where there are no major problems of the kind referred to above, it would seem preferable for the Commission to adopt this alternative, which also gives greater control over network performance and technical maintenance. In other areas, particularly those with a variety of terminal equipment types and high rate of innovation, overall advantages may favour direct purchase by the subscriber.

10.4.5 Possible Future Approaches to Telecommunications Tariffs. Under the economic concept of utility, the value of a good or a service is equated to the maximum price a user is prepared to pay for it. It has the effect of putting undue emphasis on the immediate financial value, while taking little account of macro-economic considerations and possibly none of social values.

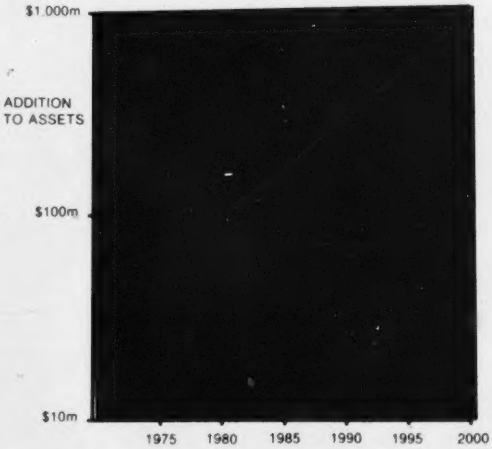
A broader view of utility needs to be taken by an organisation which operates a protected monopoly. This is especially true of the telecommunications service, in view of its potential importance in influencing future societal attitudes and levels of social equity.

It is desirable that tariffs should take account, in some way, of both cost and value. The difficulty is of course to find a measure of ultimate value. One approach would be to determine the relative capability of different media (telephone, telex, facsimile, videophone, etc.) to deliver 'relevant information' to users. The concept of relevant information capability is not just the bandwidth or statistical information capacity (bits per second) of the medium, but the overall effectiveness of a service in conveying useful information when coupled to the user through his perceptual sensors. For example, growing evidence suggests that TV-type video, despite a high statistical information capacity—about 1500 times (100 Mb/s vs. 64 kb/s) that of audio—may convey very much less than a proportional increase in usable information. Conversely, facsimile may have a very high useful information capacity relative to its statistical information capacity. Today, we have only the glimmering of understanding of 'information value' in this sense, but in the future when this might be better established one can conceive of a cost/value ratio which might be reflected in tariffs levied. This may be fairly interpreted as an attempt to incorporate into a quantitative evaluation what are essentially non-quantifiable social factors. It may be, however, necessary to adopt an openly qualitative approach when attempting to comply with what is now a specific obligation incorporated into the legislation which requires the Commission '. . . to perform its functions in such a manner as will best meet the social, industrial and commercial needs of the Australian people for telecommunication services . . .'

The NTP group has sought to identify desirable social objectives. One in particular, 'social equity', is capable of being advanced by appropriate policies on tariff setting. It would for instance be an obligation on the Commission to be aware of social disadvantages which might accrue to some individuals if they were unable to afford the cost of new telecommunications facilities, and to represent to Government the case for specific concessions. This could occur, for instance, if, in due course, educational services are transmitted over Commission networks.

APPENDIX 1

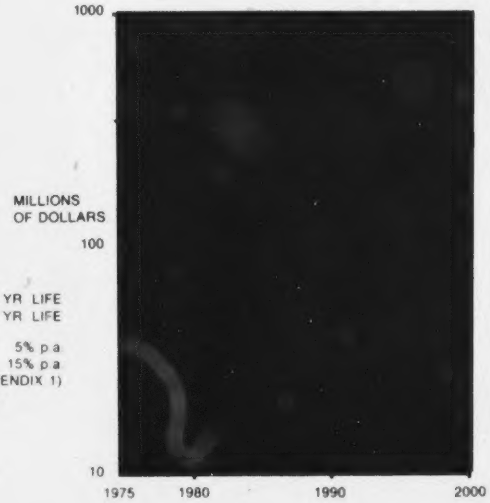
The changing pattern of telecommunications investment. Based on intermediate demand between high and low estimates (1972/73 prices)



SHADED AREA REPRESENTS UNCERTAINTY ABOUT EXTENT OF COST REDUCTION POSSIBLE AS NEW SERVICES DEVELOP
BASED ON INTERMEDIATE DEMAND BETWEEN HIGH AND LOW ESTIMATES.

APPENDIX 2

Telecommunications profits — future relativity between telephone and other services



ASSUMPTIONS DEPRECIATION – TELEPHONE ASSETS 20 YR LIFE
OTHER ASSETS 12 YR LIFE

RETURN ON INVESTMENT – TELEPHONE SERVICES 5% p.a.
OTHER SERVICES 15% p.a.
(ASSUMING LOWER COST RANGE OF APPENDIX 1)

APPENDIX 3.1

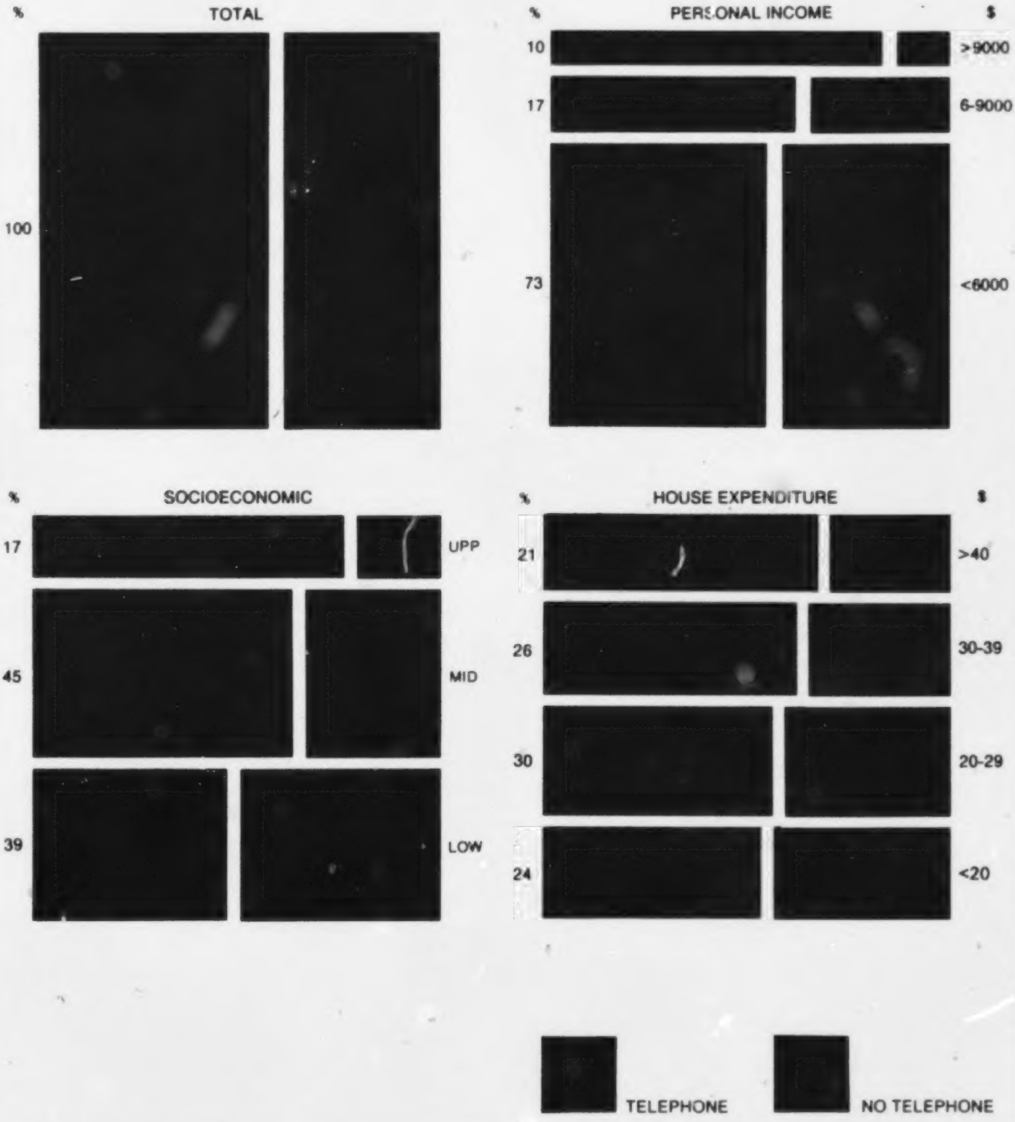
McNair Anderson Prime Prospects Report 1974/1975. Survey of Telephones in Households by Categories (See also Appendix 3.2)

Category	Class	1971/72		1972/73		1973/74		1974/75	
		% with phone	% in class	% with phone	% in class	% with phone	% in class	% with phone	% in class
All households surveyed		60	100	59	100	59	100	59	100
Socio-economic*	upper	81	16	81	17	80	17	78	17
	middle	68	47	65	45	65	45	65	45
	lower	48	37	48	39	48	37	49	39
Regional	city	—	—	—	—	63	67	65	69
	country	—	—	—	—	53	33	49	30
Personal income	less than $6000	—	—	57	85	57	79	56	73
	less than $8000	59	92	—	—	—	—	—	—
	$6000-$9000	—	—	71	11	65	13	63	17
	more than $8000	80	7	—	—	—	—	—	—
	more than $9000	—	—	87	5	85	8	85	10
Food and household expenditure	less than $20	57	39	56	37	55	27	55	24
	$20-29	64	37	62	36	57	34	58	30
	$30-39	66	15	68	19	63	24	64	26
	$40 or more	71	7	69	8	70	14	69	21

*Classified by interviewer by quality of residence.

APPENDIX 3.2

McNair Anderson prime prospects report 1974/75. Survey of telephones in households by categories (see also Appendix 3.1)



APPENDIX 4

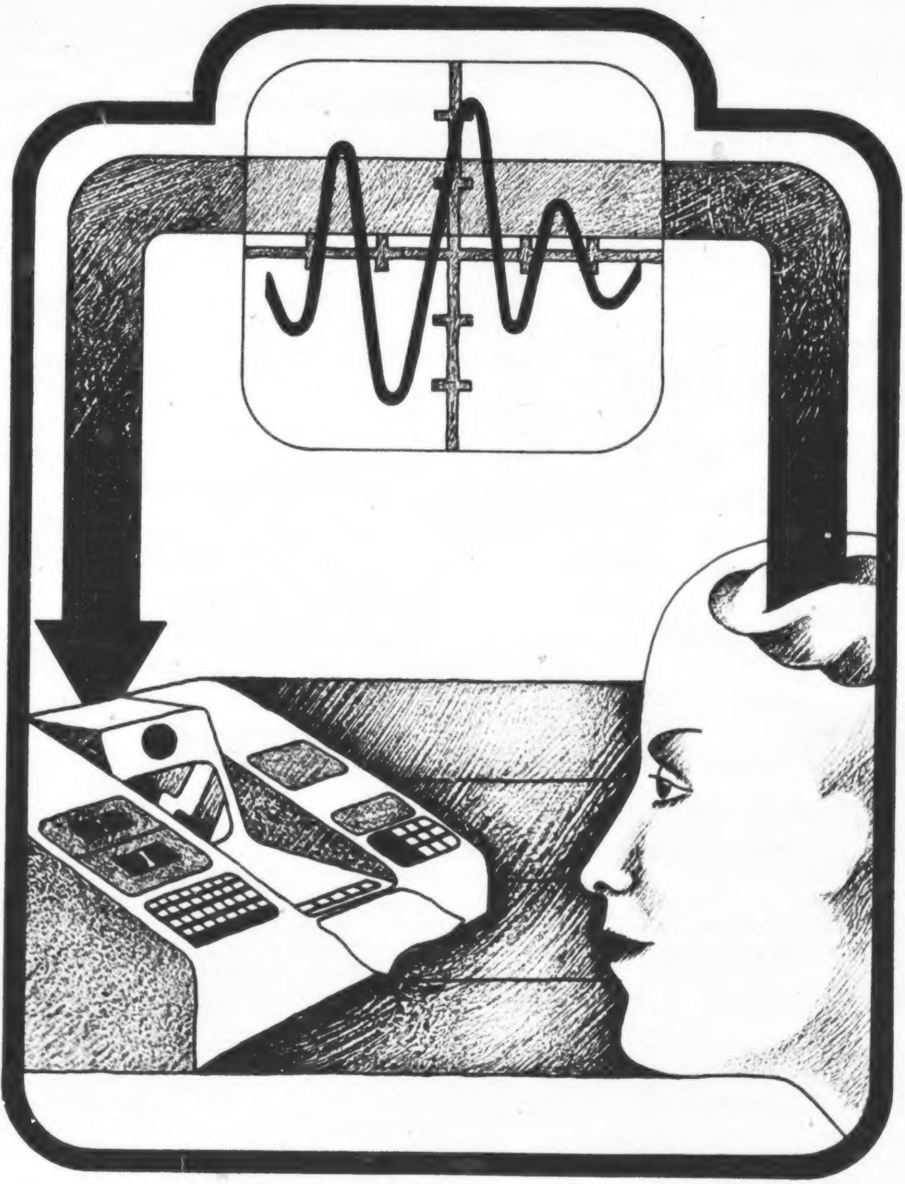
Disposable Income and Family Expenditure — Australia 1967/68

Income expenditure ranges ($) (1)	Income frequency (2)	Relative frequency of column (2) (3)	Expenditure frequency (4)	Relative frequency of column (4) (5)
Below 1,000	310	5.69	203	3.73
1,000-1,999	553	10.16	607	11.15
2,000-2,999	1008	18.52	1133	20.82
3,000-3,999	1194	21.94	1329	24.42
4,000-4,999	884	16.24	916	16.83
5,000-5,999	608	11.17	540	9.92
6,000-6,999	313	5.75	307	5.64
7,000-7,999	220	4.04	180	3.31
8,000-8,999	128	2.35	89	1.63
9,000-10,999	113	2.08	90	1.65
11,000 and over	112	2.06	49	.90
	5443	100.00	5443	100.00

NOTES

1. *The data was obtained from The Australian Survey of Consumer Expenditures and Finances, 1966–68, conducted by N.T. Drane, H. R. Edwards and R. C. Gales.*
2. *Disposable Income is income after deduction of income taxes and addition of transfer payments, e.g. Child Endowment.*
3. *Average annual incomes in the year 1967/68 (i.e. Average weekly earning x 52) was $3,400 compared with $6,150 in 1973/74.*

11. FIELD RESEARCH



11.1 INTRODUCTION

Forecasts of telecommunications technology development being made throughout the world point to vast potential markets for telecommunications services. These include provision of new facilities on existing networks as well as a range of new network services, such as data services, visual telephony, computer-aided instruction and mobile radiotelephony.

These developments present market opportunities which differ from the traditional telecommunications authority business of providing what is basically a telephone service. Their importance in sustaining the continued financial viability of telecommunications will increase as future telephone penetration approaches saturation.

Any assessment of future telecommunications services and facilities raises the question of the measurement of their effectiveness. Despite the amount of theorising on this subject, there has been little field research giving rise to results which might be useful in evaluation, although recent overseas activity suggests that research is being put in hand to overcome this deficiency. There is now wide agreement that field research is essential as an input to forecasting long range market development, since existing market research techniques are inapplicable where radically new facilities, or long time spans, are involved.

The need for the Commission to evaluate also the complex relationships between telecommunications technology, the community in general, users in particular, dependent institutions and, finally, the organisation of the Commission itself, is becoming increasingly evident.

At present, the Commission regularly conducts field experiments and trials to evaluate the performance of particular services, facilities and techniques. However, in the context of this discussion, the term 'field research' will refer to trials of new services radically different from the telecommunications services which exist at present. These trials are dependent on the development of new technology and, therefore, are likely to involve sizeable investments of capital and manpower resources. They also would involve users in entirely new learning situations in relationship to telecommunications.

The objectives of this field research are:

- To assess the effectiveness and acceptability of particular new telecommunications facilities in a working environment, as a guide to potential demand
- To provide 'hands on' experience and to gauge users' responses to advanced telecommunications facilities in a real situation, and their adaptability to new facilities; to generate possible new uses unforeseen by the system designers
- To assess users' views on the range of tariffs in comparison to alternate services
- To indicate the research and development and the further developmental trials that would be necessary before the facilities could be provided in the network
- To assess the ability of contemporary technology to provide these facilities and provide an indication of the cost structure of the development
- To enable practical field experience to be gained by Commission field staff in new technologies

Realisation of the first three objectives would increase our understanding of the interactions between telecommunications technology and society. At present, our understanding is such that we are not able to say what kinds of side effects would arise if more, or less, technical sophistication and diversity were included in the telecommunications service. Certainly, the unquestioning and direct translation of overseas experience and technology into an Australian context is a risky undertaking. Telecommunications concepts and services develop differently in different countries. For example, Australia's use of public telephones is very different from Europe and North America where in-dialling is permitted; the virtual absence of vandalism in Japan has led to quite different patterns, again, of public telephone placement and use. As a further example, Canada and U.S.A. have developed cable television very differently, despite their apparently similar societies.

11.2 ADMINISTRATION OF FIELD RESEARCH

In the past, the experience of the Commission has been based mainly on customer reaction to Commission-designed and selected apparatus and services. The future utility of trials of advanced facilities in the field depends on the involvement of users in the trial process from the outset.

Planning for field research should begin with the formation of a multi-disciplinary controlling group including representatives of administrative organisations with responsibilities in the regions in which the trial is proposed. To assist in formulating objectives, defining structure, and evaluating the output of the trials, approaches should be made to users who can best define the needs to which the system is to respond. Appropriate manufacturers should also be approached because they are the group who will ultimately produce the system for network use.

Field research conducted by the Commission will need to be administered in conjunction with the relevant State telecommunications administrations, since any new network trial must take place within the administrative control structure of the existing network. This dependence on the State administrations for technical, logistic and administrative support requires that the financial, administrative and technical relationships be properly defined. For some years, field research will be directed from Headquarters, but the continuous gaining of experience by State administrations will help later initiation of research by local organisations. The success of field research of telecommunication facilities and services will rest on the co-operation of all involved parties, including any urban planning groups involved. A concerted effort will be needed to reach agreement on the objectives of the field research, the practical programming and time-scaling involved and the source of the necessary professional and technical skills, funds and equipment.

Several new decentralised city developments under way in Australia are already directed by multidisciplinary planning groups, with community participation. Integration of trials of new telecommunications facilities into these developments provides an excellent opportunity for the Commission to gain experience in this field. In particular, the planning team directing the introduction of the Monarto development centre, in South Australia, has been involved in continuous discussion with the Commission on the possibilities of provision of advanced telecommunications facilities as an integral part of the city plan.

Federal Government organisations, such as the Department of Urban and Regional Development, the Cities Commission and the Australia Council, are also evincing interest in the forecast potential of telecommunications services for new areas and renewal of older existing areas. The Public Service sees a potential for telecommunications in its plans for decentralisation of departments and of work activities within departments.

11.3 APPROACHES TO FUNDING

If field research into new telecommunications devices is integrated with trials of new social structures, such as new regional development centres, urban renewal projects, work decentralisation or new educational concepts, the Commission's capital contribution may be reduced. In situations where telecommunications can be considered as central to the new structure, as would be the case in a work decentralisation trial or establishment of a regional growth centre, joint contribution to the capital outlay for the telecommunications research could be expected from such groups as the City Development Commission, the telecommunications industry, local business interests (such as banking or supermarket chains) and education authorities. Such arrangements already exist in developments of this type overseas, for instance, in Tama Newtown, Japan.

11.4 TARIFFS FOR FIELD RESEARCH FACILITIES

The question 'How much is the customer prepared to pay?' is central to the introduction of any new service, and field research offers an opportunity to explore the relationship between the facilities, the price and the demand.

The tariff strategy should be part of the initial planning for the trial. This strategy would not aim to recoup the full development costs of each trial, but would ensure that users make a contribution not too far from the price that might be charged assuming reasonable future penetration of the service. Tariff aspects are discussed further in Chapter 10.

11.5 PROGRAMME OF FIELD RESEARCH

The cost of field research is heavily dependent on the amount of technical development required to support this research. There is a necessity to examine seriously the programme of field research to ensure that particular trials are not commenced before the supporting technology can be economically provided or simulated, but in time to use the output of the research to condition the way in which the technology can be developed for network use. The timing of particular trials within the field research programme is dependent on continuous monitoring of technical developments and indicators of developing needs and markets.

For example, the existing network may at present be used to support a trial of new services such as access to data over a telephone line for display on the home TV screen, of the form of the BPO's 'Viewdata' service. A trial which required the use of optical fibre reticulation for similar services could not be undertaken at the present time without considerable outlay for development of the medium.

In addition to trials in new communities on new media, field research may be conducted in established communities making use of existing plant, or new technologies. Research which explores the advantages of exploitation of existing plant should be regarded as having highest priority.

Where practicable, pilot trials of new developments should be conducted to examine practical questions of operation, before embarking on field research involving large capital expenditures.

The following examples, whilst not representing a recommended programme, are the types of field research that are seen as essential for the forecasting of demand for future telecommunications services, with an indication of the scale of costs involved.

Year in which research might be commenced. (Evaluation Period)	**Trial Description**	**Approximate Total Cost**
1976/77 (2-3 years)	An 'in-house' trial of advanced telecommunication facilities, encompassing switched videotelephony, facsimile, hands-free telephony and access to a data retrieval/information service on a commercial time-share computer.	$400,000
1977/78 (3-5 years)	Data service on the existing switched network, accessed by telephone and displayed on home TV sets, into 100 homes.	$200,000
1977/78 (3-5 years)	Cable television to 100 homes on coaxial cables in a new area, providing 24 channels, with minimal response capability. Off-air reception aerials, cable and all connections to the CTV network would be provided by the Commission.	$50,000 (the development of software and hardware for ancillary services carried out by other organisations such as educators, business, etc.)
1980/81 (3-5 years)	A copper wire network, operating digitally at 64 Kbps, in a new decentralised centre, providing digital telephony, a range of digital information services and integrated switching and transmission techniques, for 500 homes. This trial requires an upgraded reticulation network with access to a range of information, education, marketing and data services and an interface with the existing network. It is assumed that suitable digital transmission and switching equipment has been developed overseas to marketable level and R&D costs have been largely avoided. (Continued characterisation of network capability would be needed to support trials of this type.)	$200,000 (over and above providing normal telephone service to these locations. The development of software and hardware for ancillary services carried out by other organisations providing the information services.)
1984/85 (5-10 years)	Optical fibre reticulation network in a new decentralised centre, providing videotelephony, cable TV and audiotelephony, for 300 homes.	$2,000,000

The quoted approximate total costs of the foregoing field research include the social and technical evaluation of the trial performance, as well as any research and development costs associated with the development of new hardware. Where possible, available equipment should be utilised to reduce the need to develop special equipment for the programme of field research.

This evaluation process should include discussions with the participants on the possibilities of withdrawal of the service after completion of the evaluation. Continuance of the service may be conditional on the capacity to recover continuing costs.

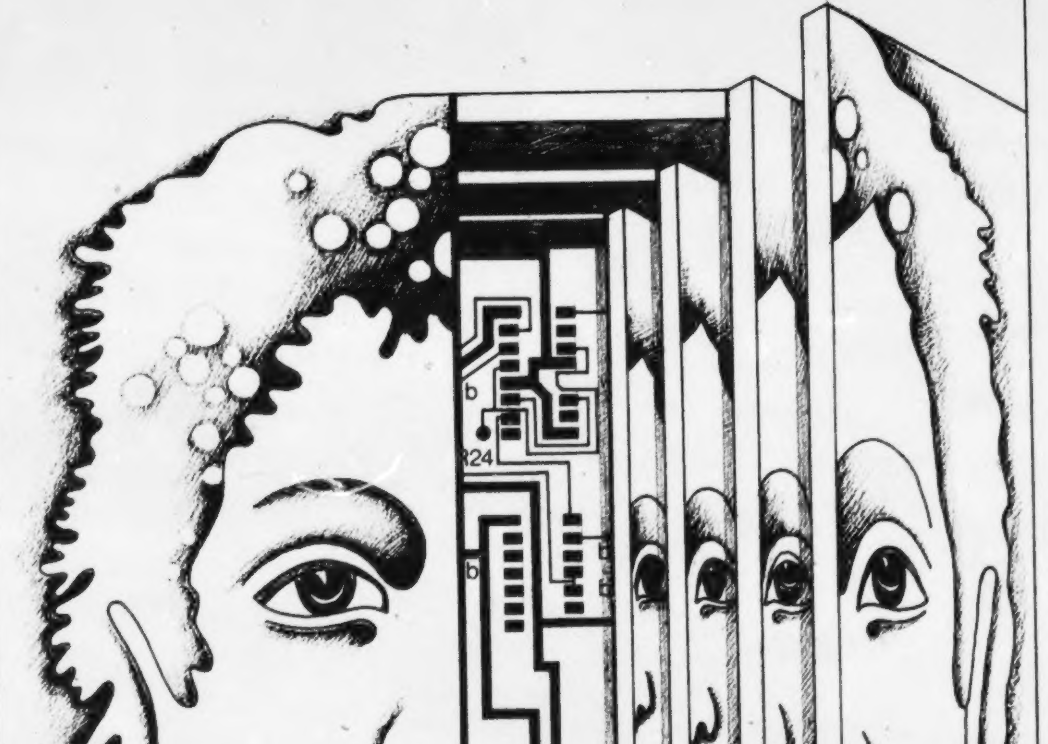
RECOMMENDATIONS

From this discussion, there are several steps which the Commission might take to secure a greater understanding of the value of future telecommunications in society. This understanding is necessary if the future telecommunications needs of the community are to be catered for adequately. It would also provide a better appreciation of the market for future telecommunications services, and secure the Commission against any criticism that it was failing to recognise society's telecommunications requirements.

The following action is recommended to promote these understandings:

1. The Commission conduct a programme of field research into new telecommunications concepts, facilities and equipment. This programme to include:
   - (i) an 'in-house' trial of advanced communication facilities;
   - (ii) a trial of advanced telecommunications services and facilities in one of the new urban growth centres necessitating continued Commission involvement with the urban planning group directing the project.
2. The Commission commit, in principle, capital expenditure of the order of $500,000 per year for an initial five year period for the field research programme (this corresponds to less than 0.1% of capital works expenditure over the period); additional capital funding should be sought from other appropriate bodies; individual trials within this programme to be subject to normal approval procedures.
3. This field research be adequately publicised, not only among the users involved, but also among telecommunications users at large, and the staff of the Commission.
4. The field research be conceived, applied, managed and analysed within a multi-disciplinary framework, with early involvement of the participants in the planning phases. The Commission should take steps to gain experience in this method of operation to generate suitable methodology for the successful direction of field research. (See also Chapters 5 and 7.)

12. OPEN PLANNING



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12.1 INTRODUCTION

Recent years have seen wide questioning of previously accepted values in our society — values reflected in attitudes about population growth, the role of women, the environment, resource conservation — as well as a questioning of the wisdom of the un-restrained application of technology in the pursuit of economic growth.

There has also been a growing uneasiness about the 'style' of government and administration at all levels. This has not been a questioning of representative government as we know it, but rather a call for more open government; that is, for more personal and informal procedures and relationships between government and the community. The feeling is that the traditional processes — from the level of representative parliamentary government and its administrative departments to public utility, public commission and local government level — are in danger of becoming too remote, too 'out of touch', unresponsive; that processes need to be devised which ensure that the community continuously participates in planning and decision-making processes at appropriate stages. In other words, the call is for some sort of broadly-based, flexible open planning.

Criticism of long-established and traditional procedures may come in a generalised form, such as that which NTP has itself encountered in its interaction with the public; a latent but strong suspicion of all planning by large government — and business — organisations. With this goes a very marked apprehension about the possibly adverse effects of future technology.

But the criticism may be in a more specific, more articulate form. One aspect has been made quite strongly to NTP. It is based on what many people see as technocratic attitudes among planners. The technocrat asks the pragmatic question — 'Will it work well?' not 'Is it good for people?' The technocrat tends to see the solution of social problems in the application of more and better technology. Questions of values are someone else's concern.

It has been suggested that:

'there are probably some very clear characteristics of the technocratic culture, including considerable common experience in terms of education, income level, mobility, and general lifestyle, which provide a quite different perspective than, say, the factory worker or the housewife. To a large extent the conceptions of the future embraced in Telecom (2000) are extensions of that lifestyle. Given that these may form the basis for future social developments they may amount to imposition of the lifestyle of a relatively small segment of the population'. (John Burke, NTP Seminar on Information Industry, 1974.)

To meet the sort of criticisms set down here, obviously an increasing interaction with the Commission's customers — potentially the whole of society — is required. Obviously, also a very flexible, open approach to planning is required.

So far there has been no widespread demand for open planning in the particular field of telecommunications. This is probably because the consequences of decisions in this field have had much less visible impact — less aesthetic impact — than those of housing, highway, town planning or other bodies. Recent opposition to proposals for radio towers and exchange buildings, however, reflects a growing public concern for the physical environment in the telecommunications context. But the social environment in relation to telecommunications development is also relevant. When the potential of future telecommunications to catalyse important social transformations is considered, it is likely that public pressure for a voice in decisions about telecommunications purposes and goals will become much more acute.

There are also very cogent reasons deriving from contemporary social theory which also support the implementation of open planning concepts. It is widely accepted among social scientists that Western societies are moving into conditions of greater instability and turbulence. Overall, the most significant characteristic of social turbulence* is the apparent existence in society of environmental forces which are beyond the scope of any single institution to control — for example, inflation, crime waves, industrial conflict.

There is strong evidence pointing to the lesson that the capacity of complex systems to survive in a turbulent environment will be greatly increased by political and administrative decentralisation. Society's responses to social turbulence are already evident in world-wide trends as diverse as student action, worker participation, local conservationist activities and the call for open planning. These diverse trends reflect an underlying process in society working towards increasing community involvement in decision-making — a process likely to be a lasting force in re-shaping Western society.

In approaching the question of the implementation of open planning it is useful to begin with a review of the scope of decisions involved in providing telecommunications services generally. Then an examination can be made of the case for community participation in the various decision areas. Subsequently, the possible machinery to achieve such participation can be considered. What follows is essentially an exploratory presentation designed to stimulate discussion rather than an exhaustive, definitive account of open planning procedures.

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*Social turbulence is discussed further in Chapter 1 of Part B.

12.2 DEVELOPMENT OF EXISTING SERVICES

Where a service already exists — such as telephone, telegraph and telex — it could be argued that the level of demand exhibited at any time reflects society's evaluation of the worth of the service, as revealed by its aggregate willingness to pay; provision of service to that level is thus a response which automatically commits resources to the level determined by society.

This argument has a measure of truth in classical economic theory, but can be questioned on several counts. Firstly, it assumes that willingness to pay is an accurate measure of social value. Secondly, telecommunications demand arises from a multiplicity of individual decisions about personal expenditure trade-offs, which do not include an examination of overall national resources, expenditures and choices. The extent to which such additional knowledge might change individual decisions is debatable; nevertheless, we do know that some Australians are quite disturbed when they are told that our annual national capital investment in public telecommunications is currently running at over $700m and questions are raised about whether this is the right level of allocation of national resources, for example, vis-a-vis education or health services. Thirdly, the very existence of the service creates social and economic pressures for others to subscribe, and hence becomes a force perpetuating its own future demands.

12.3 NEW TYPES OF SERVICES

These arguments become much more significant for the introduction of new types of services, the full social and economic implications of which are certainly not well known even to 'experts', let alone the general public. There is an obligation, therefore, to inform society as fully as possible of the types of future services that might be feasible, and what we see as their respective economic and social benefits and costs, at both individual and national levels. For example, if a new type of service — such as a videophone service — is eventually going to require a major resource commitment to sustain, then it could be argued that society should be made aware of the future resource implication in advance of any decision to introduce it. Conversely, we need to be able to gauge the extent of likely community support for future service types to give us assurance that new services introduced are those that meet genuine needs. Whilst this is necessary to safeguard the financial viability of new services, the social obligations are even more fundamental, because of the potential influence of future communications on social structure. There are therefore cogent arguments for community participation in decisions about the types of major new telecommunication services to be provided.

12.4 CHOICE AND DISPOSITION OF PLANT

Putting aside the question of service ends, and considering only their means of achievement, the major decision areas here include the choice and disposition of plant, implementation policies, and tariff structures for new services.

Community concern with the choice and disposition of telecommunications plant is relatively limited in comparison with most other public utilities since a large part of the plant is underground and, generally speaking, has little direct impact on the environment. Exceptions are terminal equipment (styles and facilities), final distribution schemes (e.g. overhead or underground), and the form and siting of radio towers and telecommunications buildings. Any public interest in this area of plant and its disposition would be likely to centre on environmental aesthetics at the local level, and could involve the Commission in discussions with the local community about the issues and alternatives, at an early stage in planning.

Apart from an issue of this sort, it is difficult to see that community involvement in purely technical planning is necessary, or indeed possible, because of innate complexity. However, broader issues related to the choice and disposition of resources could arise from time to time where society's views would need to be represented; for example, the question of allocation of the radio frequency spectrum, where its use for telecommunications of one type may prejudice it being available for others.

12.5 IMPLEMENTATION POLICIES

Implementation policies include the timing, location and quality standards of the telecommunications service provided. Decisions in these areas can directly affect communities if, for example, implementation policy favours a particular geographical location at the expense of another; a 'geographical' approach to the introduction of a new type of service might well be the most attractive in achieving low costs but introduces equity conflicts. Guidelines for priority of service, where demand exceeds available resources, are another example. Such guidelines should ideally reflect an assessment of community values about priorities. But the problem of arriving at and codifying community values on such matters is, of course, a formidable one.

12.6 TARIFF PLANNING

General approaches to telecommunications tariffs broadly polarise into two. One view holds that telecommunications should compete on an equal basis with other demands for national resources, in which case the telecommunications authority should function as a business. This implies fixing a level of tariffs which would service its capital and contribute reasonably to new capital formation; in other words, the aim should be to make a reasonable profit. This is the philosophy embodied in the operations of the Commission, as required by the Telecommunications Act, 1975.

The alternative approach is that there are 'externalities' (economic benefits) over and above those benefits reflected in the price paid for service. For example, some recipients of calls derive economic benefits, in addition to those accruing to the originators, who pay the call charges. This view holds that tariffs may be set at such a level that revenues are below costs; the authority may operate at a nominal financial loss, yet nationally contribute a net economic surplus. Supporting this welfare economics approach is the view that telecommunications provides additional social functions — e.g. protection of life and property and support of decentralisation policies. This view holds that immediate costs should not dictate the charges levied for service. This view is frequently applied to postal services, but it can bring management problems — since profitability is no longer available as a measure of performance — and reduced staff morale, stemming from a commonly-held public view that loss-making and inefficiency are synonymous.

Within each philosophy there is, however, room in the telecommunications tariff structure for differential rates which reflect differing social values. For example, it may be decided that, overall, the telephone service should be profitable, but this still leaves room for flexibility on the apportionment of charges as between rental and calls, unit-fee and long-distance, etc. At this level 'political' attitudes generally determine the approach — for example, that a basic telephone service is the right of all, so rental should be minimal; or, that country centres have a special national importance, therefore, long-distance charges should be reduced.

12.7 SUMMARY OF DECISION AREAS

From this brief review, it is possible to classify broadly, telecommunication decisions which are relevant to an open planning philosophy as being either at a local community level (geographical or common-interest community), a regional level or a national level. The 'region' in this sense is an accepted geographical area — typically a State or electoral division — and a suitable entity for management purposes, for example, target setting, accounting and resource allocation. Summarising, some examples are:

Community Level

- siting of public telephones, buildings, radio-towers
- underground or overhead distribution
- scope and facilities of local CTV schemes
- trials of advanced facilities

Regional Level

- regional telecommunications investment
- regional priorities

National (and International)

- telecommunications objectives
- telecommunications share of national resources
- major tariff policy
- introduction of new national services
- RF spectrum policy
- interconnection policy for telecommunication terminals

12.8 MACHINERY FOR OPEN PLANNING

It is clear that different forms of open planning machinery would be needed to handle the very different scope of decisions ranging from community to national level. The machinery would also need to be modified to accommodate whatever was considered to be the appropriate degree of public participation at each level. This could range from minimal involvement to the other extreme where the community itself becomes the decision-maker.

Various models have been proposed in the literature for open planning by a public utility. Without community participation, the utility interfaces with the community solely at a public relations level. It does not actively seek responses although, in its decision-making, it may take into account what it perceives to be 'in the public interest'. This characterises the way in which public utilities have traditionally operated, some, to their credit, achieving a high degree of prestige and public confidence. However, in a changing social climate this stance is becoming less tenable. Emerging critical views of organisations which once enjoyed the most prestigious image, testify to this change.

The first level of participation requires that the utility communicates interactively with the public, disseminating information about its activities, presenting alternative solutions to current problems, offering choice about future directions and actively seeking responses. This approach would include structured discussions with community groups having a special interest in communications, sampling of community opinion through interviews and surveys, sometimes extended by the appointment of consumer advisory committees or nominating consumer or union representatives on the board of directors of the utility. Although decision-making remains with the utility, it is at least enhanced by a greater awareness of, and sensitivity to, external perspectives and needs. The process can be represented by the model in Fig. 1.

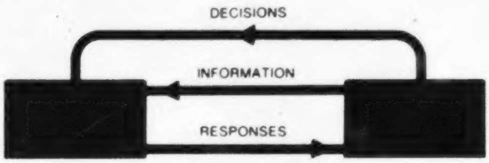

Fig. 1.

The next level of participation could be the establishment of an (ideally) independent decision-making body, knowledgeable in the public utility field, which would weigh argument from both the utility and the public, balancing the financial and other interests of the utility against the social and environmental values of the community. In the absence of such a body and where there is intense conflict, the courts are sometimes called on to adjudicate, or a commission may be created by government to hear evidence and rule or recommend on a specific issue.

In some countries, permanent telecommunication tribunals or commissions have been established. Experience shows that safeguards are needed to prevent such bodies becoming bureaucratic, extending their power base, or being unduly conservative. Also, permanent tribunals have traditionally been primarily concerned with government regulation, adjudicating on the competing interests of big power blocs, rather than with the direct interests of the community or users. It is interesting that recent court-mandated changes in the U.S. Federal Communications Commission procedures actively encourage citizen participation in communication issues, and may be ushering in a new role for that Commission.

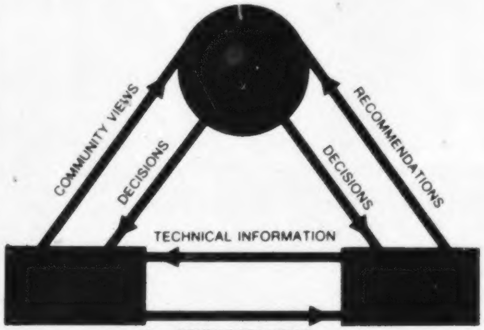

Fig. 2.

The independent decision-maker model is represented in Fig. 2.

Whilst this arrangement ostensibly gives the community equality of advocacy, in practice the community usually lacks the technical, organisational and financial resources to mount an equally powerful case. Another criticism is that the creation of a third party adjudicator immediately casts the utility and the community into conflict roles, rather than establishing conditions where each sees the other as mutually supportive and both try to work toward an acceptable solution.

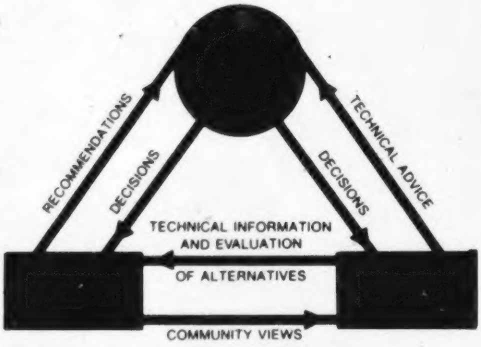

Fig. 3.

Many variants are possible in seeking to improve on this model. In one variant, initiatives or recommendations are made by the community group itself. This puts pressure on the utility to interact strongly with the community in the development and evaluation of alternatives since the utility may not submit recommendations to the decision-maker, only technical information. This arrangement is represented in Fig. 3.

Both models (2) and (3) imply that there are issues that cannot be resolved mutually. However, many decisions could be made through the creation of ad-hoc local groups having representation from both the utility and the local or regional community, with recourse to the independent tribunal only as a last resort. The initiative to set up local machinery for co-operative decision-making rests largely with the utility, since public action is usually only mobilised in opposition to a decision already taken.

The ability to anticipate issues of public sensitivity and concern requires a heightened social awareness on the part of the utility, whilst the need to examine what might be seen as purely technical issues from an entirely different standpoint, requires the generation of a multidisciplinary approach within the utility planning organisation. Working within a mixed team of engineers, economists and social scientists is a challenging and frequently difficult assignment, but rewarding for all members in opening up new perspectives on common problems. Fostering of this approach would seem to be a fundamental prerequisite to successful mutualist planning with community groups.

For telecommunication issues of national significance, and particularly where the utility is government-owned — and, therefore, may also be an instrument for implementing national economic and social policy — it would not be appropriate for an independent tribunal to be the final decision-maker. Involvement of government in this way would only be necessary for major issues requiring new or changed legislation or, if within the ambit of existing legislation, where the subject would nevertheless be considered of sufficient importance to justify parliamentary debate.

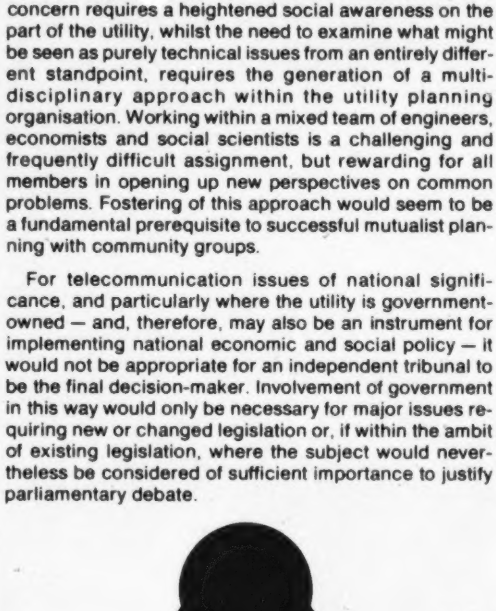

Fig. 4.

In principle, parliament should be society's ideal representative body for resolving national issues. But parliament needs to be properly informed before embarking on courses of action with potentially far-reaching social and economic consequences (and that could only be reversed at substantial national cost). Here the independent tribunal could perform an intermediary role where submissions from all interested sectors could be studied, a thorough examination of alternatives made and recommendations framed for parliamentary approval. This arrangement is indicated in Fig. 4.

12.9 PRACTICAL CONSTRAINTS

The models of community participation, as presented, are highly idealised, and public authority experience — certainly in Australia — is limited to certain urban, freeway, educational and welfare projects. There is little experience in open planning for utilities such as water supply, telecommunications* and power, although recent adverse reaction by unions — with some public support — to several important new power generation proposals in Australia confirm the need for a more responsive approach in this latter field.

The first difficulty is to define 'the community' for a particular decision area. For example, whilst a freeway routing decision most immediately affects those residents in close proximity, there are secondary effects for the whole community of freeway users spread over a large area. Telecommunications poses similar boundary problems — for many issues the community is the whole nation and participation must necessarily be formalised through procedures along the lines discussed in later models.

Minority pressure groups, notoriety seekers and cranks, local politics and the apathetic, present obvious problems and the differences between different sectors of a particular community may be greater than those between the community and the utility. This reinforces the view that decision-making will be more satisfactory if the issues are thrashed out at the local 'political' level where the debate is meaningful for those concerned, rather than decisions being taken by a remote authority. The process thereby absolves the utility from a measure of the social responsibilities of the decision — which, it could be claimed, it should not be asked to carry; its new responsibility being rather to promote and facilitate decision-making as close to the community level as practicable.

Open planning also makes substantial demands on utility resources, even in the limited phase of active community discussion and information dissemination. This would, of course, be increased in procedures where the utility supplied resources to support an examination of alternatives by the community.

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* Except in establishing telephone service in Australia's low density rural areas where there is close consultation with the local community.

Another fundamental problem arises when it is decided, because of social or environmental aspects, to adopt solutions that are not least-cost. There is no clear-cut answer; for example, if residents in a newly-developing area demand fully underground construction where the prevailing standard is for terminal pole (overhead) lead-in, then the community group may have to pay the difference. On a much broader scale, if it is decided, for example, that isolated areas should have telecommunications facilities at normal costs as a welfare entitlement, then the difference could be funded by national subsidy.

Perhaps the most difficult problem of all is changing the internal culture of the utility organisation to accept the concept of genuine community participation. Organisations whose business is marketing advanced technology find it difficult to acknowledge the existence of any expertise, relevant to the decisions to be taken, in lay community groups. The issue, however, is not one of technical expertise but of end-service, purposes and values. No one would suggest that an airliner designed by a community would be preferable to one designed by Boeing or Lockheed. But the fate of the American supersonic transport project shows just how wrong technologists can be in their judgement of what a society wants.

12.10 COMMUNITY PLANNING

How far can telecommunication development planning be taken out of centralised control and devolved to the local community level? This is a question frequently posed by social planners but one which raises formidable problems for telecommunications management. The idea of grass-roots, community planning may be attractive in principle, but it has inherent and substantial difficulties stemming from the integral nature of networks such as the telephone or telex network. Firstly, piecemeal development of a network must result in vastly increased costs due to:

- the smaller-sized plant units of development —for example, the pair-kilometre cost of subscribers' cable increases rapidly with smaller capacity cables
- problems of relatively random interconnection of communities and of achieving technical compatibility
- differing service requirements and standards

It is interesting to reflect that this haphazard development was the way in which telephone networks first started, but they were quickly amalgamated into large organisations because of the enormous economies of scale and of co-ordinated planning and operation. Indeed, the unitary nature of today's telecommunications networks makes such a concept completely unworkable — certainly for any service providing a universal, selective person-to-person facility, such as telephone, telex or switched data services.

However, a form of community planned development might be workable for distributive or 'broadcast' types of service when the distribution is not individual to each subscriber, but rather a tap from a common feed. The obvious example is a local cable television (CTV) system. In this type of network, the installed plant for a given area is much less dependent on the number of subscribers than it is with individual distribution, and the network can be more readily extended geographically. There would still be problems of the initial layout and some cost penalty for later unplanned extension of services, but not to anywhere near the same extent as for person-to-person services. One approach to funding local community planned services — such as a CTV system which provides community access or educational facilities — is to view them as another form of welfare service to be funded out of a common resource pool made available for welfare purposes in a region. In such an arrangement, the telecommunications authority would assume the functions of consultant, architect, builder and maintainer of services, and the community, the role of the client. This involves a subtle but important change in traditional relationships, where the telecommunications administration is the entrepreneur, and the users of the service its customers.

This does not necessarily imply ownership by the community. There are, in fact, strong arguments favouring legal ownership of CTV facilities by the telecommunications authority. (See Chapter 5).

This need not conflict with the principle of community planning of CTV, since the community's interest is essentially concerned with the extent of distribution, sources of programme material, community access facilities and provision and use of the user response capability, but the allocation of total system capability would need to be mutually resolved.

One could conclude, then, that because of the increased cost, technological problems and resource constraints, community planning of network-type selective services is impracticable in the present era. But this may not always be so. Technological progress — for example, mini-computer controlled switching and optic fibre distribution, coupled with increasing central building costs — might change the future cost structure in such a way that it is not so dependent on the scale of service penetration and on centralised control equipment. In the long-term, it is not beyond the bounds of reason to imagine a proliferation of small telecommunications entities organised to accommodate flexibly the future varying needs of the local communities which they serve.

We should, then, keep an open mind about the future, and, meanwhile, gain experience of how community planning could operate for those local 'broadcast' type services where it appears practicable. We need to gain experience of how to organise, manage and support this concept, to see whether communities' responsibilities and capabilities can develop to match the task effectively — although there will certainly be mistakes — and to see whether the telecommunications utility image is improved and public confidence heightened through our responsiveness to current community aspirations.

12.11 RESPONSIBILITY FOR INFORMATION

Certainly, new attitudes will need to be developed and a great deal of information exchanged between the authority and the public through discussion and consultation. This is being actively pursued now as part of Australia's national telecommunications planning. The need exists not only in those areas where we feel that community planning may be feasible; equally important, there is a responsibility to inform in those areas where practicalities exclude direct community participation. Where the consolidated network approach is the only practicable one to provide a major new service and the decision process cannot take place at the local (or regional) political level, it has to be shifted to the national political level. A danger here is remoteness of decision-making, and we have to strive to make the political process operate more effectively. This means that there should be a wide-ranging exchange of information and views between the utility and the public, and informed public views conveyed to their political representatives.

12.12 ADVANTAGES OF OPEN PLANNING

There are, of course, formidable problems in implementing the concept of open planning. But it does offer the prospect of some real long-term advantages to the telecommunications utility itself. It should bring about decisions which are demonstrably more in the public interest. Moreover, the very process of mutual consultation is likely to result in a growing public acceptance of the value of the utility, an enhanced prestige generated by public confidence, and a better understanding by the public of the real problems which the utility faces in providing a service.

Apart from an improved public image, the process should result in a widening of the horizons of utility staff and improved internal industrial relations. Finally, it would cast the utility more squarely in its proper role as the provider of a service to meet public needs and avoid it being forced into judgements which rightly should be made by society itself and the communities within it.

13. THE FUTURE ROLE OF THE TELECOMMUNICATIONS AUTHORITY

13.1 FUTURE RESPONSIBILITIES

If Australia continues its current trend of transition from an industrial society to an economy in which information-based industries increasingly dominate (see Chapter 2, 'Economic Futures'), it will cast the telecommunications and computer sectors in joint key roles in the economic infra-structure. Already these two sectors together constitute around 6% of Australia's new fixed capital formation, and this could increase to 12% or more by the turn of the century. Telecommunications, once regarded as a luxury and later as a discretionary commodity, could then become indispensable to a vast range of economic, social and cultural activities.

The prospect of this likely central role of telecommunications places growing responsibilities on those who will control the future telecommunications sector and, in particular, on the telecommunications authority with its legal monopoly of public telecommunications. This implies an obligation for the telecommunications authority to:

- Sustain an adequate rate of innovation—based on both indigenous and overseas developments—to support society's increasing need for and dependence on a wide range of telecommunications facilities and services.
- Ensure that its networks and facilities have the necessary reliability and security to match an increasing social dependence on telecommunications media. A community which relied heavily on these media for much of its work functions, education and lines of supply would be highly vulnerable to telecommunications disruption—whether through technical faults, accidents or deliberate sabotage.
- Actively encourage user participation to develop, progressively, mutual understandings about the specific facilities and services that will best serve future Australian society.
- Recognise that, with increasing pervasiveness of telecommunications and consequent growing external economic benefits, the current financial objective of requiring profitability for each type of service—whilst appropriate to the environment of the present decade—may become less tenable in the long term. There are strong movements in a number of countries for recognition of the right to communicate as a fundamental human right, alongside freedom of speech and right of assembly. Consequently a basic communications facility (for example, an equivalent degree of service to that notionally covered by present telephone rental) may eventually become a welfare necessity, funded or subsidised out of national revenues. This would be a natural extension of the Commission's present social responsibilities.
- Plan the introduction of any new types of telecommunication services in ways that will support social equity, so that the distribution of telecommunications services does not worsen the position of deprived segments within society, reinforcing the power of an information elite. (A recent Melbourne study revealed, surprisingly, that the most significant deprivation of underprivileged urban sectors was lack of access to information).
- Recognise the fundamental importance of the communications/computer alliance. These two sectors are very different in characteristics of ownership, pattern of users, rate of innovation, depreciation policies, setting of standards etc., and new relationships and policies need to be developed to harmonise their future joint development (see also Chapter 6, 'Computers and Communications'). A particular issue concerns the need for measures to safeguard individual privacy where personal information held in data banks is accessible over the telecommunications system. For this reason, and also because of the immense power that would reside in a common utility handling both telecommunications and data processing, there are strong social arguments favouring legal separation of these two sectors despite the potential economics of a combined telecommunications/computer processing utility. These matters were amongst those discussed at an OECD Conference on Computer/Telecommunications Policies for Government held in Paris in February 1975, where it was agreed that Government level action is needed within member countries to develop appropriate policies. The Commission would need to contribute actively to computer/telecommunications policies for Australia.
- Recognise that telecommunications and mass media communications will develop a much closer affinity in the future. This will come about firstly by the Commission's growing involvement in cable television systems, if it becomes the provider and owner of the CTV transmission facilities. It is likely that some spare capacity in CTV systems could be used for distributing information services by the Commission—the visual equivalent of today's dial-up telephone information services. Later with optical fibre distribution, a common cable is likely to be used for both public telecommunications and cable television. Looking further to the future, the advent of fast and relatively cheap facsimile devices could permit home reproduction, on a selective basis, of a proportion of news and other information at present the province of newspapers. Future growing newsprint shortage is likely to give impetus to this.

As with the case of data processing, there are here also sound social arguments for maintaining a separation between the communications carrier and the information or the programme content on the communications media. The organisation and regulation of joint use facilities of this type will require Government policies for regulation and operation, and the Commission should participate in this policy formulation.

Much of the foregoing implies that telecommunications will become increasingly another means for implementing Government social and economic policies. In addition to the specific areas of data processing and mass media, other policy areas with telecommunications involvement could include:

- economic growth policies, concerning desirable rates of industrial automation, and productivity of the information sector
- resource conservation—particularly energy policies
- decentralisation policies, both for new growth centres and for encouraging decentralisation generally by industry and Government
- growth of knowledge industries—national information policy, for example development of ALBIS (Australian Library Based Information System)
- education, including questions of computer-aided instruction at existing institutions and the development of decentralised institutions, e.g. open universities
- implementing 'open Government' policies involving community participation. CTV systems with a response capability community information centres etc., could be important aids to participation

Vehicles by which Government could seek to implement relevant policies include taxation concessions, telecommunication tariff subsidies, research and development policies, training programmes, development of standards and financial support of open-learning institutions and community information centres.

All of this suggests that future telecommunications will be required to play a greater part in formulating and implementing policies of social and economic significance. This will require injection of new talents within the Commission, and the inculcation of attitudes extending beyond our traditional technical, financial and marketing expertise. It will also imply maintenance of close links to many arms of Government and a capability to monitor the economic and social environments to a much greater depth than has been necessary in the past.

13.2 FUTURE BOUNDARY OF THE TELECOMMUNICATIONS MONOPOLY

Most of this discussion supports the view that, in the future, it will be more than ever in the national interest that telecommunications remains predominantly in the public sector and retains its Government-monopoly position. In summary, this is because of society's increasing dependence on telecommunications and its growing relevance as an instrument of Government policy. Traditional arguments also supporting the Government monopoly view are that it:

- minimises national resources consumed in the provision of services
- maximises service coverage, with minimum costs to users and generally uniform standards and charges
- is publicly accountable
- greatly facilitates international operation

This is the view held by the British Post Office and most European administrations

In Canada and USA, diversity of ownership is fostered, whilst still preserving a monopoly within each geographic or service area of operation. It is also Government policy there to open up the competitive process as much as possible; important steps in this direction in recent years are:

- the 'interconnect policy' which permits connection to the networks of any devices (with suitable protection measures)
- the acceptance of specialised communications carriers operating in competition to the Bell system on long haul routes in USA
- 'value-added' networks whereby an entrepreneur can lease basic facilities from the telephone company, add some additional facility or service, and remarket them

The belief that monopoly stifles innovation is certainly supported by evidence that recent opening of markets to competition has produced important innovations not only by the new competitors but also by the original system operators. For example, in both USA and Canada, new digital data networks have contributed to drastic reduction in the cost of long-distance data transmission; this is claimed to be an important stimulus to the productivity of commerce and industry generally. Competition can be the grain of sand in the monopolistic oyster, irritating it to produce its own pearl!

Having studied the arguments and evidence of a number of European and North American countries, the conclusion arrived at for Australia is that we should maintain our Government monopoly of public common-carrier networks—telephone, telex, data and new networks of the future—and that there should also be common ownership of telecommunication and cable-television transmission plant. This is justified in terms of the very tangible and considerable economies of scale deriving from common-carrier provision in public networks.

Whilst acknowledging the potential advantages of competition, the forecast volumes of data, visual and other specialised traffics are unlikely to be sufficient to justify division of the market for many decades.

There are, however, certain areas which could favour a competitive approach. One relates to private switching systems, particularly for data (and other new services) where traffic flow is essentially in-house. Current policy permits private data network users to purchase their control and interconnecting equipment from outside suppliers and this approach could be continued. When a need to switch between private networks emerges, the Commission would operate the interconnecting network.

An associated area is the supply of terminal equipment where the variety of types will proliferate rapidly, especially in the data field. There is also a strong case here for continuing to liberalise our approach in order to stimulate innovation through competition, as well as to conserve capital resources in that part of the network where the largest proportional increases in capital requirements are expected to occur. At the same time, since terminal devices can be a highly profitable area, we should not abandon the field but market selectively, in competition with other suppliers, and to standards that permit ultimate national networking, where this is foreseen as a likely future need even though initial user applications are exclusively in-house. Facsimile would be an example favouring this approach.

The concept of 'value-added' services should be explored and guidelines developed that would foster entrepreneurial activity in innovative service areas, in particular those areas where the Commission has decided not to expand its range of standard services for one reason or another. Such guidelines should protect the Commission from 'cream skimming' ventures that would undermine our financial position in the face of our obligation to provide for both profitable and unprofitable services.

Continuance of the common-carrier monopoly position also implies a responsibility for positive measures to avoid becoming remote or bureaucratic in our dealings with the public or being tardy to respond to meet changing needs of users. This report has referred several times to the need to achieve greater user participation, and the present considerations reinforce this view. Similar remarks apply to the future need to continue to disaggregate organisationally, achieving progressively a higher degee of regional or sub-regional autonomy. This is not to deny the obvious role of a central organisation, but rather to point to the changing organisational balance that will be more appropriate to match society's future needs and aspirations.

RECOMMENDATIONS

From this exploration of the future role of the telecommunications authority, certain implications can be drawn for the more immediate future. Accordingly it is recommended that the Commission:

1. Support an on-going programme of multi-disciplinary studies of future telecommunications.
2. Maintain appropriate resources to monitor the political, economic and social environments and provide a focal point for Commission involvement in a wide area of Government policy issues having telecommunications implications — decentralisation, education, information policies, etc.
3. Explore ways of establishing closer rapport with telecommunication users; for example, by formation of telecommunication user representative groups, or advisory committees.
4. Sponsor studies to identify and (where practicable) quantify the broader social and economic benefits of telecommunications.
5. Further develop product costing so that the profitability of various telecommunications services and of any internal cross-subsidisations can be more fully revealed.
6. Take up at Government level the question of the establishment of appropriate machinery to study these questions and to define policies for the harmonious development of the telecommunications and computer sectors of the economy.
7. Initiate, at Government level, an examination of the future relationship between public telecommunications and mass media, with initial emphasis on cable television.
8. Further explore the possibilities of introducing competition in selected areas of telecommunications with particular reference to data communications and 'value-added' services.
9. Support the continuing devolution of decision-making to regional and local administrative units of the Commission as a means of achieving more effective interaction with telecommunication users at a community level.

LIST OF SUPPORTING STUDIES

1. Commissioned External Studies
2. External Seminars
3. Consultant Seminars
4. Overseas Visits
5. Commissioned Internal Studies
6. Discussion Papers
7. Relevant Internal NTP Papers

A brief review of external and internal studies included in the National Telecommunications Planning work programme is given in the summary which follows:

1. COMMISSIONED EXTERNAL STUDIES	**Status (at December 1975)**
Australian National University (Centre for Continuing Education, Dr F. Emery) Prepare social scenarios for the year 2000, focused on aspects of special importance to telecommunications.	Commenced October 1974. Completed April 1975 Documented in Report —' A Choice of, Futures: To Enlighten or Inform.'
Australian Sales Research Bureau. Provide an insight into the utility of the telephone service and identify areas where other forms of telecommunications media may be used.	Commenced October 1974. Field survey completed.
Professor S. Encel (Head of Department of Sociology, University of New South Wales). Consultancy and over-sighting of telephone usage study.	
University of New South Wales, Unisearch Ltd. (Professor S. Encel). Provide insights into existing and future telecommunications services by examination of the characteristic relationship between social change and telecommunications and transportation.	Commenced January 1975. Report due June 1976.
University of Queensland, Department of Economics, (Professor D. Lamberton). Study of Australian 'information industry' and implications of introducing new communication technologies.	Commenced October 1974. Phase 1 report received August 1975. (Other phases in hand). Completion date — October 1976.
University of Queensland, Department of Electrical Engineering (Dr E. Batchman). Develop a computer model to explore the social implications of future communications systems.	Commenced February 1974. Completed June 1975. Report 'Investigation of Social Implications of Future Communication Systems by Modelling Techniques' received July 1975. (Minor extensions in hand)
Professor A. J. Wearing (Head, Department of Psychology, University of Melbourne). Commissioned extension of private visit to survey and report on the activities of leading institutions in North America and Europe where social modelling is in progress. This relates to the NTP programme of research into the interaction of telecommunications and society.	Report received January 1975.
W. D. Scott/Logica (Management Consultants) Study of data communication developments in Australia from 1985 to 2000. (Stage 2 of Austdata study)	Commenced June 1975. Completion date — April 1976.
Barry Z. de Ferranti/Barry W. Smith. (Management Consultants). Pilot study of present and future uses of technology and telecommunications in education.	Commenced May 1975. Completed August 1975. Report received August 1975.
Ms J. M. Brett (Senior Teaching Fellow, Monash University). Consultant on the analysis of Delphi forecasting survey.	Completed August 1975.
University of Queensland, Department of Economics, Research Officer, M. J. Quayle. Pilot study of mobile services concerning overall utilisation of the radio frequency spectrum.	Commenced July 1974. Completed April 1975. Final report received.

2. EXTERNAL SEMINARS

Title and date	**External speakers, discussion leaders and representation**
Telecommunication Industry Seminar. 9 November 1973	Approximately 35 representatives from telecommunications manufacturing industry attended.
Seminar with Banks on Long-term Planning. 21 November 1973	*External speakers* Mr B. B. Callaghan (Comm. Banking Corp.) Mr R. H. Turner (Comm. Banking Corp.) Approximately 22 bank executives attended.
Telecommunications and Broadcasting Media–2000. 12 February 1974	*Key speaker* Mr R. Newell (Dept. of Media) Approximately 230 TV and broadcasting representatives attended.
Telecommunications and Print Media–2000. 13 February 1974	*Key speaker* Mr T. Farrell (Ed. Mgr., John Fairfax & Sons) Approximately 30 representatives attended.
Social Sciences Workshop (Joint Seminar with Centre for Continuing Education [C.C.E.] of A.N.U.) 27 February to 1 March 1974	*Key speaker* Dr F. Emery (C.C.E.) 23 representatives from universities, other education centres, government departments, trade union and travel bodies participated.
Telecommunications and Urban and Regional Planning (Joint Seminar by APO and D.U.R.D.) 9 April 1974	*Speakers* Mr D. Wilmoth (Dept. of Urban & Regional Development [D.U.R.D.]) Mr M. Payne (Uni. of Sydney) Mr W. Richardson (Cities Commission) Mr C. Benjamin (Vic. Council of Social Services) Approximately 30 representatives from various universities, government departments, commissions, and other organisations attended.
The Computer Industry (1st Seminar). 14 August 1974	*Speakers* Prof. C. Brookes (Uni. of New South Wales) Mr J. Thacker (Uni. of Adelaide) *Discussion leaders* Mr D. J. Gannon (Australian Post Office [APO]) Mr L. G. Gerrand (P.A. Manag't Conslts. P/L) Mr J. Burke (Learning Exchange, Melbourne) Mr I. Wadham (R.M.I.T.) Mr J. Marquet (Intech Systems P/L) Approximately 65 representatives of Melbourne-based groups from the Aust. Computer Society, the Aust. Computer Users' Assoc., data processing consultants and service bureaux and computer equipment suppliers attended.

Title and date	**External speakers, discussion leaders and representation**
The Computer Industry (2nd Seminar) 19 September 1974	*Speakers* Prof C. Brookes (Uni. of New South Wales) Mr J. Thacker (Uni. of Adelaide) *Discussion leaders* Mr A. Coulter (Uni. of Queensland) Mr D. Young (NTP) Dr M. White (IBM) Mr L. Gerrand (P.A. Manag't Conslts. P/L) Mr F. B. Fitzgerald (Dalgety Aust. Ltd.) Approximately 65 representatives of Sydney-based groups from the Aust. Computer Society, the Aust. Computer Users' Assoc., data processing consultants and service bureaux, and computer equipment suppliers attended.
Telecommunications and Information (Joint Seminar by APO and Information Industry). 21 October 1974	*Speakers* Prof. D. Lamberton (Uni. of Queensland) Mr J. Burke (Learning Exchange, Melbourne) Mr W. D. Richardson (National Library) *Discussion leaders* Mr J. O'Brien (NTP) Mr J. Burke (Learning Exchange, Melbourne) Mr D. Young (NTP) Mr. J. Gilding (Education Subscription Services) Mr K. Maher (Priority Review Staff) Approximately 44 representatives from various universities, government departments and other organisations attended.
Staff Associations and long-term Telecommunication Planning. 15 November 1974	*Speakers* Mr K. Turbet (Postal Telecommunications Technicians Assoc.) Mr W. F. Cox (Professional Officers Association) Approximately 30 representatives of various staff associations attended.
Telecommunications and Education. 3 December 1974	*Speakers* Prof W. Ford (Uni. of New South Wales) Mr E. Cave (Council of Adult Education) *Discussion leaders* Mr K. White (Council for Educational Planning & Research, South Australia) Mr B. Smith (Computer Consultant, Canberra) Mr M. Morris (Education Dept., Queensland) Mr J. Gilding (Education Subscription Services) Mr B. Hawkins (Vic. Institute of Colleges) Ms B. Marsh (Latrobe University) Approximately 90 representatives of universities, government departments and other organisations attended.

Title and date	**External speakers, discussion leaders and representation**
Future Telecommunications and their Implications for Australian Government Organisations. 13 March 1975	*Speakers* Mr A. F. Guster (Public Service Board [PSB]) Mr P. Y. Moran (PSB) *Discussion leaders* Mr T. Hayes (The Treasury) Mr P. Y. Moran (PSB) Mr W. Richardson (Cities Commission) Mr D. Wilmoth (D.U.R.D.) Mr W. Childs (Aust. Council for the Arts, New South Wales) Mr A. M. Smith (APO) Approximately 100 representatives from the PSB and other government departments attended.

3. CONSULTANT SEMINARS

Brief details of short-term consultancy seminars by National Telecommunications Planning Branch:

Prof J. Bright	(Director, Industrial Management Centre, Austin, Texas, USA). Conducted a series of short seminars on technology forecasting and assessment. The seminars were attended by representatives of the APO, other Government departments and academics.
Prof C. Cherry	(Electrical Engineering Dept., Imperial College of London, UK) Held discussions with NTP members during his two-day visit to Melbourne.
Prof G. Wills	(Marketing and Logistics Studies, Cranfield School of Management, UK) Held discussions with NTP members on technological forecasting and market research.

4. OVERSEAS VISITS

Overseas visits were made by members of the NTP team as follows:

3 January to 20 January 1974

Mr H. P. Guthrie Visited the USA to attend a Technology Forecasting Workshop being conducted by the Industrial Management Centre Inc., at Hilton Head, South Carolina. The workshop was concerned with the methodology and techniques for long-term technology forecasting.

18 April to 1 June 1974

Mr A. Kellock Visited the UK, Sweden, Germany, Switzerland, USA and Japan,

Mr G. D. S. W. Clark Visited the UK, Holland, Belgium, Canada, USA and Japan.

They studied long-range telecommunications policies and plans and their relation to national objectives; also planning processes and methods used for assessing the impact of future technological developments on society.

18 April to 12 May 1974

Mr K. A. Barnes Visited the UK, Germany, Sweden and Holland.

He held discussions with European telecommunications administrations which had participated in a study of the market for data communications in Europe. Subsequently, a similar study was commissioned in Australia.

30 January to 8 March 1975

Mr I. A. Newstead Visited France, Germany, UK, Canada and USA to review major policy areas relating to long-term national telecommunications planning through attendance at O.E.C.D. Conference in Paris and other associated visits to related organisations.

5. COMMISSIONED INTERNAL STUDIES

Subject	Contributing Groups
Radio frequency spectrum requirements to meet future mobile demands	Radiocommunications Construction Branch
Mobile radio technology	Transmission Systems Branch
Wideband transmission technology	Transmission Systems Branch
Computing technology	ADP Branch
Optical fibre technology	Advanced Techniques Branch
Physical characterization of plant in typical distribution areas	State administrations: Victoria, NSW, S. Aust.
Expert opinion forecasts of costs of future technology	State administrations, and a number of HQ Branches
Optical fibre telephone technology	Switching and Signalling Branch
Projected costs of digital switching	Switching and Signalling Branch
Digital transmission capability of subscriber distribution cables	Transmission Systems Branch
Cost structure of manufactured telecommunications equipment	Accounting and Supply Department
Delphi study of telecommunications developments	Senior management of Telecom Australia

6. DISCUSSION PAPERS

Number 1	The Future Role of Telecommunications
Number 2	Supplies of Copper and Aluminium in the Future
Number 3	Towards a Fibre Optic Network
Number 4	A Structure for Social Research for NTP
Number 5	Paper for IEEE Autumn 1975 Issue: Open Planning for Telecommunications
Number 6	Information — One Aspect of Communications between People
Number 7	The Substitution of Telecommunications for Travel
Number 8	The Scenario as a Forecasting Tool
Number 9	Political Environment Forecasts (in preparation)
Number 10	Change in the Telecommunications Network — A Sociotechnical Systems View (in preparation)

7. RELEVANT INTERNAL NTP PAPERS

Planning Research into Teleconference Systems

Delphi Forecasting Study

Summary of External Plant Studies

Pipe Space Policies for Wideband Subscribers' Cable

The Case for Larger Distribution Area Pipe Sizes

Practical Pipe Size Aspects — New Distribution Medium

Characterisation of Cable Systems, etc.

Availability of Suitable Subscribers' Lead-In Pipe in Metro Areas

Distribution Area Pipe Occupancy Study — Sydney

Value of Copper in Distribution Areas

Different Types of Distribution Area

Characterisation of Subscribers' Lead-Ins

Altona Distribution Area Characteristics

Distribution Area Reticulation Costs

APO Costs of Providing a Telephone Service

Overall Costs per Marginal Telephone Service

Incremental Material Costs of Larger Sized Pipes

Social Indicators

The Right to Privacy and Automated Data Banks

Technology Assessment Methodology

Augmented Cable TV

Subscribers' Broadband Distribution and Wideband Switching

Bandwidth and Bits

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Comparison of APO Telecom expenditure with GDP

Urban Telephone Development — Sydney & Melbourne. 1985–2000

The NTP Information System

A.I.P.S. Summer School, Canberra, January 1974

Telecom 2000 — Some Random Thoughts

Effect of Subscribers' Density on Wideband Network Cost

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Capability of the Switching Network

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Trial of Advanced Communication Facilities (Specification)

Delphi Forecasting Study — Education

Telecommunications — Decentralisation and Urban Planning

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Elementary Guide to Waveguides Fibres and Modes

Scenarios and Perspective Trees

NTP — Mini Delphi, January 1975 — Technical Costs

Capability of Analogue Copper Network to Carry Advanced Services

Lasers and the Spectrum

Telecom Network Studies 2000 AD — Interim Report

Questionnaire — Technological Costs 2000 AD

Cost Model Studies

Establishing Cost of Network from a Scenario

Forecasting Methodologies; Telephones in Australia

Breakdown of APO Assets — Financial & Statistical Bulletin *Vs.* Plant Unit Costs

Labour Costs — A Projection

Economic Scenarios and Their Production

Footscray Model (Cable Distribution)

Error Tolerance of Various Services — 1200/9600 bps

Optimum Network Under Concentration Conditions

Telephone Line Demand Model (II)

Digital Policy

Non-CATV Scenarios — Rough Conclusions

Subscribers' Distribution Cost Model

Cost Model of Local Crossbar Exchange

Cost of Wideband Switching and Concentration

Office Facilities Available with Wideband Distribution System

Home Facilities Available with Wideband Distribution System

Preliminary Survey of RF Spectrum Allocation

Open Planning for Telecommunications

Australian Populations: 1975–2000

Energy Consumed on Commuting Journeys

Economics of the Home Office

Economic Studies Programme

Value Change

Data Communication Policy Issues

Mobile Services — Demand

Exploitation of Present Network

Notes on Mobile Services

Optical Fibre — Broadband Distribution Policy

Technological Study Specifications

Study of Cost Trends for Digital Communications Equipment

The Perceived Role of the Social Sciences in the NTP

Report on Social Sciences Search Conference

Justification of Social Science Research Proposals

Towards a Co-ordinating Map for NTP

A Social Science Perspective of NTP

Open Planning, Values and Labels

Privacy and Access

Adapt or Perish

Set of Year 2000 Socio-Economic Scenarios